Transportation Choice and Regional Development in the Pearl River Delta

by

Gerard J. Flood

B. S. Business Administration
State University of New York, College at Oswego, 1982

SUBMITTED TO THE DEPARTMENT OF URBAN STUDIES AND PLANNING IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER in CITY PLANNING
AT THE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

JUNE 2000

Signature of Author: ____

Department of Urban Studies and Planning
May 18, 2000

Certified by: ____

Tunney Lee
Professor Emeritus
Thesis Supervisor

Accepted by: ____

Paul J. Smoke
Associate Professor of Urban Studies and Planning
Chairman, MCP Program

Transportation Choice and Regional Development in the Pearl River Delta

by

Gerard J. Flood

Submitted to the Department of Urban Studies and Planning
on May 18, 2000 in Partial Fulfillment of the
Requirements for the Degree of Master in City Planning

ABSTRACT

The Pearl River Delta (PRD) has been one of the fastest growing regions in China for the past 15 years. This tremendous economic expansion, fueled by the opening of Chinese markets to foreign investment, has created a number of complex planning issues in the region. While the PRD has become more urbanized, and its local economies more interdependent, planning functions within the region, for the most part, lack coordination and regional focus. Instead, the autonomy granted to PRD municipalities over local economic development decisions has intensified competition among localities. This drive by officials to maximize development opportunities leaves little room for regional planning initiatives. Fortunately, there has been an increasing awareness among some PRD stakeholders that the fundamental undertakings necessary to improve living standards across the region, such as infrastructure construction, economic development, housing, and environmental regulation, transcend municipal boundaries and are most efficiently addressed through the adoption of regional strategies.

One of the most important regional planning decisions facing the PRD centers on inter-regional mobility. Compared to other regions of its land size and population, the PRD lacks a highly developed road and rail network. The absence of transportation infrastructure offers PRD decision-makers the unique opportunity to plan regional growth around a transportation network that offers the greatest potential for systematic and measured development.

This research will examine the impact that land-use and transportation planning have on the spatial development and form of the urban region. Through a review of the literature on four topics directly connected to land-use and transportation planning—urban and regional decentralization, sprawl, transit-oriented development, and automobile policies—the interaction between land-use and transportation planning, as they pertain to regional development, will be examined. Next, transportation and land-use planning will be examined in two regions—metropolitan Tokyo and New York City—to highlight the impact that varying policies have had on the spatial development of these regions. It is hoped that PRD decision-makers can draw lessons from the literature review and the policy decisions made in the two case study regions.

Thesis Supervisor: Tunney Lee
Title: Professor Emeritus

Thesis Reader: Ralph Gakenheimer
Title: Professor of Urban Planning

Table of Contents

LIST OF TABLES

LIST OF MAPS

LIST OF FIGURES

PEARL RIVER DELTA STUDIO

This thesis has been written within the framework of the Hong Kong/Pearl River Studio at the Massachusetts Institute of Technology, led by MIT Professors Tunney Lee and Ralph Gakenheimer and by Project Coordinator, Dr. Nien Dak Sze.

STUDIO DESCRIPTION

The Hong Kong and the Pearl River Delta (HK-PRD) region has been one of the fastest growing economies of the last twenty years but now faces serious problems - environmental degradation, congestion, chaotic growth, fragmented jurisdictions, lack of planning and intra-regional coordination. On the economic front, HK is still recovering from the Asian financial crisis while China is facing problems in carrying out economic reform. Competition from other cities in the region such as Singapore and Shanghai has become more intense. The entry of China to the WTO will create new problems and opportunities.

HK/PRD has the advantages of a homogenous cultural region, a large internal market, skilled and motivated managers and work force and HK as a source of capital, marketing, and technology. The region is unevenly developed with the potential for new directions in transportation and vehicular use, settlement patterns, environmental regulation, etc This studio will develop strategies and scenarios for the physical development of the HK/PRD Region as part of Project 2022 which is the initiative of a consortium which has been formed to develop strategies and scenarios for positioning HK /PRD as a competitive city region. The purpose of Project 2022 is to provide the research data and analysis in urban planning, the environment and infrastructure to frame and focus the debate on how HK and the PRD should develop.

THE STUDIO TASKS AND PRODUCTS

The end product of the studio will be a series of scenarios for developing the region based on varying and inter-related assumptions about economic growth, population, land use (agriculture, residential patterns), transportation (especially auto dependency), energy use, environment, etc.

Studies at several scales - regional, local and intermediate - will be done as necessary to understand the issues. Implementation will be explored.

INTRODUCTION

For the past 15 years, the Pearl River Delta (PRD) has been one of the fastest growing regions in China. This tremendous economic expansion, fueled by China's more liberal trade policies and by the presence of Hong Kong's entrepreneurial business community, has created a number of complex planning issues for the region. While the PRD has become more urbanized, and its economies more interdependent, planning activities within the region have continued, on the whole, to be conducted within the confines of the municipal boundary. This is not surprising: regional planning structures are difficult to implement under the best of circumstances. And given the historical political divide between the Hong Kong and its neighbors in the Pearl River Delta, it is easy to understand why a "go it alone" mentality has permeated the region.

Yet it is fair to examine whether a lack of regional cooperation on key planning issues is limiting the PRD's ability to compete favorably with other global centers, domestic and international, as well as its ability to improve the quality of life for its residents. It is also fair to ask PRD leaders if the incredible growth predicted for the region can be managed efficiently without some type of regional consensus on basic planning functions such as land-use and transportation planning, housing and infrastructure development, and environmental management. Fortunately, PRD leaders and stakeholders are becoming increasingly aware that the fundamental undertakings necessary to improve living standards across the region transcend municipal boundaries and are most efficiently addressed through the adoption of regional strategies.

One of the most important regional planning decisions facing the PRD centers on intra-regional mobility. Compared to other regions of its land size and population, the PRD lacks a highly developed road and rail network. But the current lack of infrastructure, in the long-term a hindrance to regional development, offers PRD decision-makers, in the present, the unique opportunity to direct regional growth by developing policies that tightly integrate land-use and transportation planning functions. This type of a planning approach is especially important in a

rapidly growing area such as the PRD, where transportation infrastructure, to a great extent, drives regional development. In this regard, the urban and regional spatial structure, whether it consists of sprawling, low-density development or compact, high-density development, is largely the result of the types of transportation facilities built *as the region decentralizes.* As the PRD grows and expands—as people and/or economic activities move from the urban core to the periphery[1] (i.e., as it decentralizes)—transportation and land-use decisions become critical.

OVERVIEW OF THE PEARL RIVER DELTA

GEOGRAPHICAL DEFINITION

The Pearl River Delta (PRD) is located in Guangdong Province on the southeast coast of China. This research focuses on an area known as the Pearl River Delta Economic Region which covers 41,596 km^2. The economic region occupies 25% of the total area of Guangdong Province. In this thesis, the terms "Pearl River Delta" and the "PRD" refer to the Pearl River Delta Economic Region, *which includes Hong Kong*. The term "PRD ex-Hong Kong" will be used to refer to the PRD without Hong Kong.

[1] Ira M. Robinson, "Emerging Spatial Patterns in ASEAN Mega-Urban Regions: Alternative Strategies." In *The Mega-Urban Regions of Southeast Asia*, ed. T. G. McGee and Ira M. Robinson (Vancouver, BC: UBCPress, 1995). pg. 78.

Map 1 Pearl River Delta Open Economic Development Region *

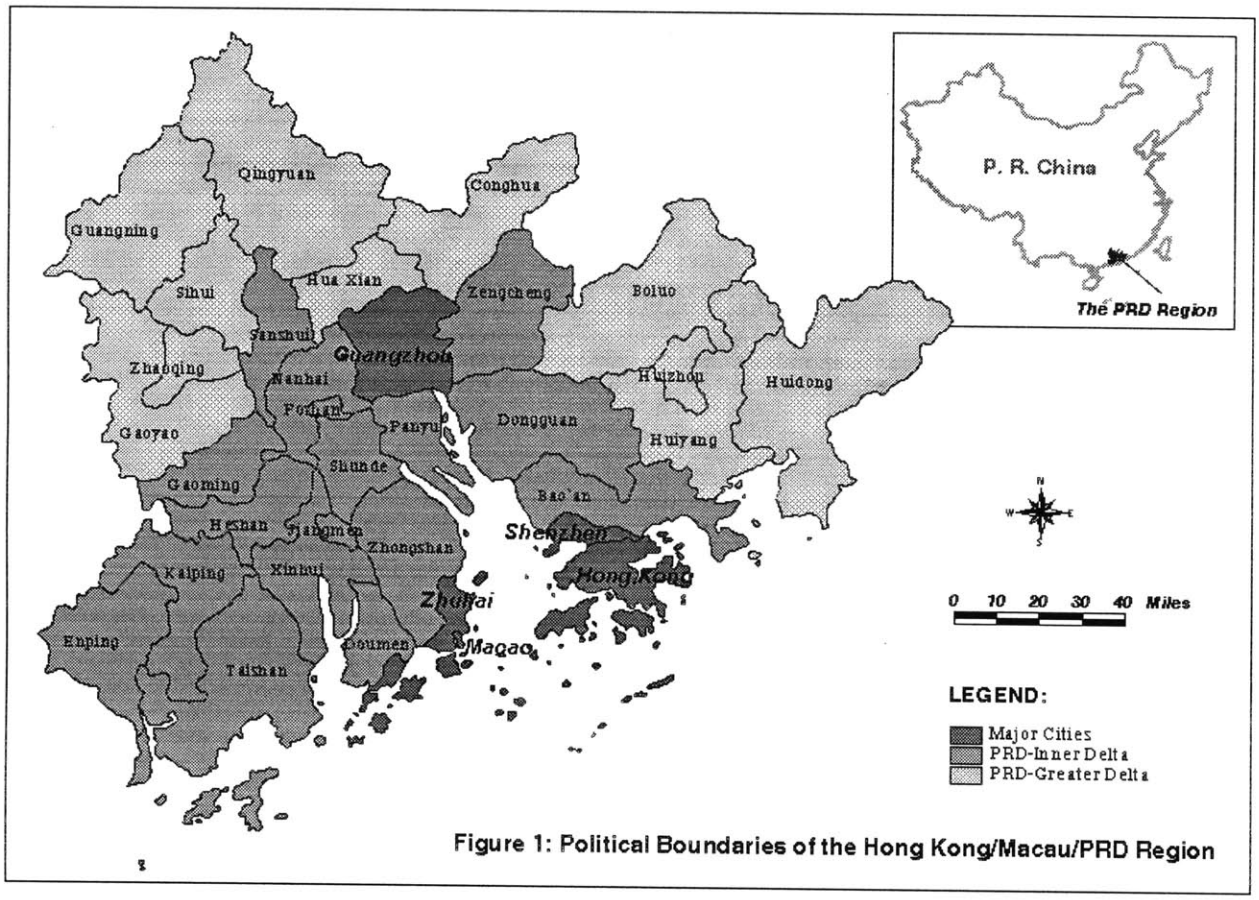


Figure 1: Political Boundaries of the Hong Kong/Macau/PRD Region

Source: *Hong Kong and the Pearl River Delta: Framing Strategies and Scenarios for Convergence, HK/PRD Research Group at MIT*

On this map, the PRD Open Economic Region consists of the "Major Cities" and "PRD—Inner Delta" sections (refer to legend).

POPULATION AND SETTLEMENT PATTERNS

Altogether, in 1993 the population of the PRD was 32 million, approximately 44% of the total population of Guangdong Province. Included in the region are the cities of Guangzhou (6.7m inhabitants), Hong Kong (5.6m), Shenzhen (2.0m), Zhuhai (.7m), Foshan (3.2m), and Macao (.4m). The region is multi-centered with the cities tending to be very densely populated while settlements outside the cities in the rural areas tending to be scattered in loosely connected towns and villages. Speculative development has left many large tracts of land vacant as developers wait for land prices to increase. In some areas outside the larger cities, housing developments and

commercial buildings dot the landscape anticipating changes in population and new business investment.

The bulk of the population in the PRD is concentrated along the coastline on the eastern side of the Delta in a fast-growing corridor between Hong Kong in the south and Guangzhou in the north. Hong Kong has experienced a moderate population growth rate of 3% per year since 1990[2]; however, most of the population growth in the corridor has taken place outside of Hong Kong. With the liberalization of economic development policies, rapid urban growth is occurring around established centers. The non-agricultural population, as an indicator of urbanization, has increased form 9.62 million in 1982 to 17.75 million in 1990—an annual growth rate of 8%. The population of Shenzhen, north of the New Territories, has grown by a remarkable 1292% over the same period.[3] Population and economic growth in the PRD can be attributed to it status as a Special Economic Zone, a government designation that has helped it attract international investment. The designation of the entire province as an Open Economic Region has attracted capital and population to other parts of Guangdong as well. These special economic designations will be described more fully in the economic reform section.

Table 1 Population Predictions for the PRD and Hong Kong (in million)

Area	1990	Medium-Term (2001)	Long-Term (2011)
Shenzhen	2.02	3.36	4.92
Rest of PRD (ex-Hong Kong)	21.00	32.39	34.68
Sub-total PRD (permanent)	23.02	35.75	39.60
PRD non-permanent	3.50	4.80	4.80
Overall PRD (ex-Hong Kong)	26.52	40.55	44.40
Hong Kong	5.62	6.64	7.52
Total (HK + PRD)	**32.14**	**47.19**	**51.92**

Source: *Consolidated Technical Report on the Territorial Development Strategy Review, Planning Department, Hong Kong Government, 1996, from Study of Development Trends in Guangdong*

Urban densities in the PRD are high, with Hong Kong leading the way with some of the highest urban densities in the world. In 1998, Hong Kong's overall population density was 6,330 people

[2] Ming Zhang, "Working Paper" (Summer 1999).

[3] *Consolidated Technical Report on the Territorial Development Strategy Review*, Planning Department, Hong Kong

per km^2 with some sections of Kowloon and the New Territories reaching densities of up to 50,000 per square kilometer.[4] Urban density will be an important factor directing future residential and non-residential settlement patterns in the PRD. In 1993, the amount of urbanized land in the PRD stood at 43%, compared to 29% and 21% for Guangdong Province and China respectively.[5]

As the PRD becomes more urbanized, and as per capita incomes rise, these changes will increase pressure to improve the quality of urban life by decentralizing some functions from the primary cities to the urban fringe. This in turn will affect where businesses and commercial enterprises locate and where people choose to live. It also has direct implications on questions of regional mobility and the transportation options provided to PRD residents.

TEMPORARY POPULATION

Another important consideration in planning for future regional development is the large number of temporary workers living in the region. The rapid development of the PRD, and the job opportunities for unskilled labor available in the region, has attracted many migrants from other parts of China, particularly from rural areas.[6] In 1993, temporary workers accounted for 29.2% of the total PRD population (excluding Hong Kong), an increase from 15% in 1990. Shenzhen has the highest ratio of temporary-to-permanent population, with the temporary population outnumbering permanent residents by more than 2 to 1.[7] Most of the temporary workers are young women, nearly all live in dormitories near the factory, and most return to their homes after working for two to four years. The disposition of this population has significant implications on regional development. If the region is able to broaden its economic base and provide a wider range of employment opportunities, then the temporary population could make the transition to permanent residents who are more firmly rooted in the local economy. This would affect the

---

Government (Hong Kong: 1996), p. 15.
[4] Ibid.
[5] Me Kam Ng and Wing-shing Tang, "The Pearl River Delta Urban System Plan: An Analysis," Dec. 1997, pg. 12. (op. cit., 1996:9)
[6] Ibid. p. 17.
[7] Ibid. p. 18.

spatial configuration of the PRD as new settlement patterns develop to accommodate a larger number of permanent residents, a population with increasing per capita incomes demanding higher quality housing, a wider range of commercial development, and more reliable transportation facilities.

PER CAPITA INCOME

There is a significant difference in per capita income between Hong Kong and the rest of the Pearl River Delta. The gap is the result of the different economic systems under which the two regions developed. Hong Kong, with its colonial roots and stable market economy, went on to become one of the world's most open markets; economic development in the PRD, on the other hand, crept along under four decades of a planned economy. The gap in per capita income between Hong Kong and the PRD has narrowed since China allowed foreign investment in the PRD but it remains an important distinction within the region. It should also be noted that within Guangdong Province, the income gap between Shenzhen and the rest of the region is significant. Shenzhen has prospered under its status as a SEZ. Consequently, an income gradation has developed within the PRD with most of the wealth concentrated in Shenzhen and Hong Kong.

ECONOMIC REFORMS

The PRD prior to economic reforms: Prior to the economic reforms established in the 1980s, and the subsequent 20 years of rapid industrialization and urbanization, the PRD and Guangdong Province were primarily agricultural with the exception of densely urbanized areas around Guangzhou, and the neighboring cities of Foshan and Jiangmen in the western part of the PRD. Because government policies at the time favored economic development in urban areas rather than rural ones, the PRD attracted very little state investment prior to the economic reforms. [8]

The PRD after economic reforms: In the late 1970s, the Chinese government implemented the Open Door Policy, the package of economic reforms and incentives responsible for the incredible

growth experienced by the PRD over the last 20 years. Under the Open Door Policy, Zhuhai and Shenzhen were declared Special Economic Zones (SEZ) and with this designation each city received greater autonomy over internal economic planning as well as the authority to offer special tax incentives to foreign investors. The success of the SEZs led the government to designate the Pearl River Delta as an Open Economic Region (OER) in the mid-1980s, giving all cities and municipalities in the PRD some degree of economic development autonomy. The emphasis in such areas "has been on the creation of a vigorous, export-oriented, light industrial base to absorb surplus labor and to provide an economic foundation for the resultant urban growth."[9] Together, these economic reforms have given residents of the PRD the highest per capita income in the country (1990 income of 3,426 yuan compared to 1,812 yuan at the provincial level and 1,250 yuan at the national level). They have also fueled an economic expansion that has made the PRD one of the fastest growing regions in China.[10]

ROLE OF HONG KONG ON REGIONAL DEVELOPMENT

Hong Kong has strong economic and social ties with the PRD, and has traditionally served as the economic engine for the region. By relocating labor-intensive manufacturing operations to the PRD, Hong Kong businesses have taken advantage of the economic reforms initiated in China, accounting for over 70% of foreign investment projects in the Guangdong Province (1997).[11]

EVENTS DRIVING CROSS-BORDER COOPERATION

A number of events are propelling leaders in the PRD to explore regional problem-solving measures, most of them related to the fast pace of growth in the region. These events should be looked at in more detail:

---

[8] Ibid. p. 10.
[9] Planning Department, Hong Kong Government, p. 15.
[10] Zhang, Ming, (Lin 1997)
[11] Hong Kong Trade Development Council, Available: http://www.tdctrade.com/mktprof/china/mpgud.htm 7 April 2000.

Reunification of China and Hong Kong

Hong Kong was reunited with the People's Republic of China in July 1997, ending its 155-year status as a British Territory. Hong Kong and China have adopted a "one country-two systems" political and administrative relationship, where Hong Kong will continue to operate under its own legal and economic framework for the next 50 years as a Special Administrative Region (SAR). It will also maintain control over its border with Guangdong Province. Regardless of the political and administrative arrangement devised by Hong Kong and Chinese governments, one fact is clear: Hong Kong will eventually be folded back into China and will cease to operate as a separate entity. Both sides are beginning to recognize the competitive advantages to cross-border cooperation.

Projected population growth and urbanization

As stated before, the Pearl River Delta has undergone a 20-year period of intense urbanization. The corridor between Guangzhou and Hong Kong, in particular, has seen extensive urbanization and development. The Hong Kong Planning Department predicts that by the 2011 population in the PRD could reach 52 million.[12] The pressure to develop planning systems that can improve the quality of life for both current residents and newcomers to the PRD will be intense.

Rising incomes and the emergence of a middle class

Along with the increase in numbers, the demographic composition of the population is likely to change. A broader range of job types is expected to emerge in the PRD, attracting more educated and skilled labor. This increasingly affluent population will likely look for higher levels of services, such as public transportation, and at the same time will likely be more sensitive to environmental concerns. Such issues go beyond problem-solving at the municipal level and require regional approaches.

[12] Planning Department, Hong Kong Government, p. 16.

POLLUTION

The rapid pace of industrialization and urbanization in the PRD has taken its toll on the natural environment as serious problems have developed related to air and water quality. Local governments, fearing a loss of revenue and investment, are reluctant to place environmental controls on local businesses. Approaches to pollution control in the PRD are unsystematic and reactive (after the fact) rather than preventative, with strict regulations and sanctions. Pollution must be addressed from a regional perspective to ensure actual inroads into solving the regions environmental problems. Environmental management must function at the regional level.

COMPETITION

In the global economy, the PRD is competing head-to-head with other regions, both foreign and domestic, for capital investment. T. G. McGee speaks of an intense competition among "global mega-urban regions" in Asia where regions compete on the efficiency with which they move capital, people, and commodities. For example, he gives high marks to Singapore in this regard, commenting that the government has created a stable business climate through policies that resulted in "radical changes in the internal distribution of housing, industry, and recreation"[13] Singapore accomplished this orderly distribution of urban functions through a policy based on tight integration of land-use and transportation planning. Although the Singapore model cannot be directly applied to the PRD (Singapore is a small city-state, the PRD a much larger region, with many population centers), it does serve as an example of the benefits to be gained when planning functions—particularly land-use and transportation planning—are coordinated within a given area.

[13] T. G. McGee, "Metrofitting the Emerging Mega-Urban Regions of ASEAN: An Overview," in *The Mega-Urban Regions of Southeast Asia*, ed. T.G. McGee and Ira M. Robinson (Vancouver, BC: UBCPress, 1995) p. 19.

PRD AS INTEGRATED REGION: A NEW CONCEPT

The PRD finds itself at a crossroad. Decisions being made now about regional development, or for that matter, decisions not being made, will have a lasting impact on the physical and social development of the region. The PRD of 2020—in terms of where people live, where they work, how they get to work, their quality of life, their health, and their environment—is already being shaped by today's decisions or inaction.

In order to implement a "region-building" program (i.e., cross-jurisdictional agreements that transcend municipal boundaries for key issues such as transportation, environment, land-use policy, and economic development), Hong Kong and the cities and towns of the Pearl River Delta need to develop effective methods of working together. If the different entities can not work as a cohesive unit (perhaps the most efficient administrative structure under which to implement programs but politically an unlikely outcome), then they must function as a group of municipalities acting under guidelines that will ultimately make the region competitive with other global centers. This statement is made with full awareness of both the political difficulties associated with higher levels of regional cooperation and the administrative difficulties with constructing regional planning strategies. However, the difficulty of decision-making will only be intensified the longer the PRD develops without a regional focus. When a physical urban and regional environment has been allowed to develop in an uncoordinated manner for decades, retrofitting it for greater efficiency will be extremely costly.

SIMILARITIES WITH OTHER ASIAN URBAN REGIONS

The challenges faced by the PRD as it attempts to develop strategies for effective growth are not unique. Other regions in Asia have faced, or continue to face, the same group of conditions emerging in the PRD. Ira M. Robinson notes that rapid urbanization and industrialization, a fast-

growing population, environmental degradation, infrastructure deficiencies, and traffic congestion are all problems associated with expanding and developing city-regions in Asia[14]. Although Robinson's research focuses on the cities of ASEAN (Association of Southeast Asian Nations), the dynamics taking place around growth and development in these regions are similar to those found in the PRD and therefore worthy of consideration.

DEFINITION AND CHARACTERISTIC OF MEGA-URBAN REGIONS

Robinson refers to these fast-growing regions in Asia as "mega-urban regions" or extended metropolitan regions. Mega-urban regions have the following characteristics:

- Rapid urbanization resulting in cities extending into the hinterland, beyond their historic geographical limits;
- "Amorphous and amoebic-like" spatial forms, with no established geographical boundaries;
- Regional growth that tends to accumulate along transportation corridors, either expressways or railway lines, that extend out from the traditional urban core;
- Growth that "leapfrogs" in all directions, putting new towns, industrial estates, and housing projects into areas that were previously agricultural or rural;
- Lack of "effective land-use and environmental controls and other institutional machinery necessary for managing the new urban complex."

These conditions exist in the PRD, particularly in the corridor from Shenzhen to Guangzhou. Intense development has taken place along the Shenzhen-Guangzhou Expressway, beginning a process of sprawl that threatens to overtake the region if growth continues to be oriented toward the automobile. Environmental problems are rampant as incompatible uses (agriculture and industry) exist side-by-side, operating without strong environmental controls. The boundaries of Shenzhen and Guangzhou have been pushed out into the surrounding area by the growth in population, and the Dongguan region is spread out and developing with few controls. Shenzhen,

[14] Robinson, p.78.

it should be noted, has put a great amount of effort into the physical planning of its central business district (CBD), but growth at the boundary is not as well-regulated and continues to extend the urban area into the hinterland.

How mega-urban regions grow

Robinson observes that *decentralization* has been the key strategy used by mega-urban regions to alleviate the negative conditions brought about by rapid urbanization and industrialization. Robinson defines decentralization as "growth of the population and/or economic activities occurring on the periphery and fringe areas of the central city or along transportation corridors emanating from the urban core, within a metropolitan area or metropolitan region." He claims that decentralization occurs in two ways:

1. As low-density residential and/or industrial sprawl, with an uneven pattern of development, occurring at the periphery of the urban area and outward along transportation corridors, or

2. As concentrations of population and/or industry or mixed-use development ("nucleations") in the shape of centers or subcenters, including new towns and satellite developments.

Robinson points out a key distinction between how these two forms of decentralization come about. The former process unfolds as market forces take hold and dictate the location of development. The latter process requires a deliberate effort on the part of government to plan and control growth.

Spatial forms of mega-urban regions

Robinson identifies three basic spatial models that can be used to describe how population and economic activities are distributed within a geographical area. These models can apply to the

distribution of population and employment within a metropolitan area, the larger metropolitan region, or even on the national level. The spatial models are:

A monocentric spatial form:

A model in which a large proportion of the region's population and employment are located in the urban core or the central business district.

A spread-out, sprawling spatial form:

A model in which all types of land-uses (housing, industrial, commercial/retail, and recreation) are spread out in non-contiguous locations along the region's main transportation routes. This form is the result of unplanned and uncontrolled decentralization, and, according to Robinson has been the most prevalent trend in urban development in both developing and developed countries since the end of World War II.

A polycentric spatial form:

A model that also results from decentralization, but instead of sprawl, population and employment are located in "several interdependent, diversified, and relatively self-contained centers, cities, and towns within a metropolitan area or region." This model focuses on the "close integration of residences and places of work in centers and subcenters, each developed around and near a transportation node and containing a mixture of retail, commercial, light manufacturing, and relatively dense residential areas." The development of this regional form is generally the result of deliberate government policies to plan for and direct growth. Because of the high levels of government intervention required to plan for such a spatial form, such an orderly form has not been common in both developing and developed countries.

Robinson uses the terms *nucleation*, *multinucleation*, and *reconcentration* to describe the "process of spatial development" organized around "high-density clusters or nodes of employment and population (i.e., mega-urban regions). On the regional level, these clusters of population and employment collectively form a polycentric or multi-centered spatial structure.

The result is "decentralized concentration"—the opposite of a "sprawling, spreading, and scattered pattern."

Advantages and Disadvantages of the Spatial Models

Robinson evaluates the pros and cons of the three spatial forms, devoting most of his attention to the advantages of the polycentric spatial pattern and the disadvantages of the sprawling, unplanned decentralized pattern. In comparison with the polycentric pattern, the sprawling pattern has the following disadvantages. It:

- Spreads infrastructure over a more decentralized population, thereby increasing the overall per capita infrastructure costs. At the same time, it burdens the existing infrastructure in the urban core by redirecting investment to richer, more affluent suburban areas.
- Results in automobile-dependent land-uses and longer commutes to work, residential, and recreational areas while at the same time creating a pattern of land-uses not easily serviceable by public transportation.
- Contributes to social inequity within a region by causing economic hardship on only certain segments of the population, requiring households to purchase second cars and isolating household members who do not have access to a car or public transportation.
- Uses urban land and services inefficiently.
- Increases the number of local governments within a region, making regional governance more difficult while adding to the complexity of planning for region-wide initiatives.
- Degrades the environment and results in the loss of agricultural and other open space.

The polycentric spatial form, on the other hand, brings many advantages:

- The decentralization of jobs into subcenters within the polycentric regional structure relieves congestion without sacrificing the benefits of "metropolitan-wide agglomeration economies.
- A multi-centered region creates a collection of cities with large and distinct markets.

- This spatial form is the most energy-efficient configuration because urban functions are contained and clustered making them more easily serviceable by public transportation.
- It conserves natural resources, agricultural lands, and the environment by concentrating development in distinct locations.
- It lowers new infrastructure costs by making use of existing infrastructure in already built-up urban areas.

SPATIAL MODELS: RELEVANCE TO THE PRD

One thread that is woven through all these growth processes and their physical outcomes (i.e. the spatial forms) is *level of concentration of urban functions*—that is, the density of infrastructure, buildings, open space, and residences in any given area. As Robinson explained, some regions are rigidly planned in order to accommodate higher concentrations of urban functions in selected areas (i.e., a polycentric region); on the other hand, most urbanized regions in the world have, over the last 40 years, developed in a more chaotic manner, with much of the growth auto-dependent and directed by the placement of highways, resulting in urban functions that are more highly-dispersed throughout the region. The key question for regional leaders in the PRD: Given the amount of growth that has already taken place in the region, and given the continued growth in population and urbanization expected over the next 20 years, will PRD decision-makers steer development in ways that lead to a more concentrated, polycentric regional form (i.e. an efficient "hierarchy of cities with defined and complementary functions well linked by transportation and communication networks")[15] or will development take the shape of regional sprawl?

THE LINKS BETWEEN THE CENTERS

Most regions are somewhat polycentric. Even those with sprawl usually have identifiable concentrations of development, albeit at much lower densities than found in the other two spatial forms. These spatial forms are also scalable—they can apply to a city, a metropolitan area, a

[15] Mee Kan Ng and Wing-shing Tang, p. 22.

larger urbanized region, and even to a nation. For example, Singapore and Tokyo are polycentric on a city scale (Singapore with distinct clusters of development, separated by preserved open space; Tokyo with dense cluster around transit stations and expansive development in between the clusters). At the same time, Tokyo is polycentric on a regional scale (large concentrations of population and employment in the cities of Tokyo, Yokohama, and Kawasaki), with less dense (but still substantial) development between the major cities.

Since most cities and regions are, broadly speaking, polycentric, then the *transportation links between the centers* dictate the overall spatial form of the city or region. Consider:

- If the links between centers consist predominately of roadways, creating a spatial pattern that best accommodates the automobile (extensive expressway network, wide streets and boulevards, an over-supply of parking), and if there is inadequate transit, then the likely spatial form will be *sprawl.* Growth will be auto-dependent and pressure will be at the periphery of the metropolitan area/region to extend outward into undeveloped sections of the region.

- If the links between centers are a combination of roadways and transit, then transit opens the door for greater densities and the development of mixed-use centers. Rail has the capacity to distribute a large ridership among the region's mixed-use centers and an extensive rail network can capture a high percentage of workday commutes, taking pressure off the highway network. Policies that manage transportation demand can serve as a deterrent to single-occupancy vehicle (SOV) ridership.

- If the links between centers are primarily rail transit, then a polycentric development pattern is possible. Rail can support densities that, if automobiles were used, would lead to intolerable levels of highway congestion. Again, policies that manage transportation demand can serve as a deterrent to single-occupancy vehicle (SOV) ridership.

The "links between the centers" is an oversimplification of the much-discussed connection between land-use and transportation planning. This factor is, nonetheless, a key consideration for PRD leaders because the links chosen will drive the spatial form of the region. Transportation systems shape the spatial form of cities and regions by the mixture of land-uses and densities that takes place along transportation corridors. Different transportation modes encourage different land-use and densities. In general, subway and commuter rail trigger higher densities and more compact development while development along expressways often results in lower density, more sprawling development, generally with segregated land-uses. And these segregated uses encourage more trip-making by automobile owners.

CRITICAL CHOICE

So again, decision-makers in the PRD find themselves at a crossroad. How will they decide to link the centers? Through the review of literature on sprawl, transit-oriented development, and policies that limit automobile ownership and use, this thesis hopes to demonstrate that the most competitive, most sustainable, and the most efficient means of providing regional transportation in the PRD is through a well-integrated land-use and transportation planning strategy that does three things: 1) implements region-wide goals, with definable actions for achieving those goals, 2) focuses on a high-capacity regional rail system that directs development into concentrated nodes in both existing population centers as well as in underdeveloped parts of the PRD, and 3) discourages private auto use through policies that make automobile ownership and driving more costly, at least when compared to the transit alternative.

It should be noted that the emphasis on rail is not an anti-highway, anti-car policy. In fact, a network of expressways is needed to facilitate the movement of goods throughout the region. Highways are also necessary to provide mobility to the rapidly growing number of car owners in the PRD. However, a regional rail network is needed to balance the mobility equation. Without one, reliance on the automobile will soar. The demand for new highway facilities will spread the

region out further from population centers, and the opportunity to integrate land-use and transportation planning will gradually erode.

It should also be noted that choosing the appropriate mix of facilities is only one part of an overall regional approach to transportation and land-use. Shaping or changing the driving behavior of residents, through policies that manage transportation demand, as well as other automobile restrictions, is an important component of an overall regional plan that promotes mass transit and limits automobile use. The policy challenge is to accomplish this while also preserving the opportunity for people to own and enjoy automobiles.

SPRAWL

Much has been written about sprawl over the last decade, particularly in the United States where fast-growing regions in the South and Southwest are, after years of automobile-dependent growth, beginning to contend with what many view as the negative regional impacts of low-density development. Many of these regions now face crippling levels of highway congestion, infrastructure demands (roads, sewers, school construction, and water connections) that burden local budgets, and highly segregated land-uses that promote and perpetuate automobile use. Further, exclusionary zoning ordinances in newly developed areas on the periphery of the region usually restrict the types of land-uses, effectively eliminating opportunities for affordable housing and higher-density suburban development. In the United States in particular, sprawling development and the reliance on the automobile have resulted in a high percentage (when compared to other developed countries) of urban land devoted to roads, expressways, and parking facilities; the loss of wetlands and other ecologically sensitive lands to highways and the diffuse land-use that highways invite; and a range of other negative environmental impacts.

Most of the discussion about controlling urban form is aimed at the desirability of reducing sprawl. To do so, alternatives for urban and regional growth need to be identified. One type of growth advocated by many environmentalists and planners could be characterized as the "anti-sprawl" approach. This approach focuses on methods of land-use planning that encourage

compact development, emphasizes the use of existing infrastructure in already developed centers, encourages mixed-use development in centers and subcenters, and provides a variety of housing options—medium- to high-density housing clusters—for a variety of income levels, effectively increasing average densities throughout a region while decreasing the amount of land consumed.[16] A key link to this type of land-use development is transportation. Specifically, anti-sprawl development is only feasible when high-quality public transportation is provided.

Sprawl has become an extremely politicized topic, primarily because of the land-use restrictions governments would have to impose on property owners in order to curb sprawling development. This has prompted research into the true costs associated with sprawl. Contrary research has cited the alleged benefits of sprawl. Most of these are based on the American experience of sprawl and are the mirror images of the costs. The alleged benefits include time savings in suburb-to-suburb commuting because most jobs and residences are now suburban, monetary gains to both consumers and developers from the construction of housing on undeveloped land, and the positive social gains from the increased affordability of home ownership.[17] This view, however, generally ignores the externalities (i.e., the social costs) associated with a more dispersed urban landform. These externalities are, by their very nature, harder to identify and quantify, and they are often distributed inequitably among a city's or region's population. For example, the city resident who takes public transportation to work is affected by the poor air quality and congestion caused by suburban highway commuters, and the presence of suburban jobs are of little economic benefit to the inner-city worker if public transportation does not reach those jobs.

One aspect of sprawl that should be examined is the extent to which it and suburbanization reflect people's preferences for low-density living. Peter Gordon, Ph.D., and Harry W. Richardson, Ph.D., professors in the University of Southern California School of Urban Planning and Development, imply that the preference for lower-density living is universal:

---

[16] *The Full Social Costs of Alternative Land Development Scenarios: Theory, Data, Models and Recommendations,* U.S. Department of Transportation, Federal Highways Administration, prepared by Parsons Brinckerhoff, Quade & Douglass and ECONorthwest, June 1998, p. 21.

> "Most people throughout the country [United States] are choosing to live away from commercial areas, enjoying the private spaces afforded by single-family homes set back from streets and the mobility and accessibility offered by the private automobile. This lifestyle is not imposed by malignant U.S. policies, for suburbanization trends are global: in Canada without mortgage interest tax deductions, in Europe with high gasoline taxes, in Seoul with plentiful public transit, and in Mexico City with its huge subway subsidies."[18]

However, sprawl may not be as universal as Gordon and Richardson suggest. Australian researchers Jeffery Kenworthy and Peter Newman contend that cultural forces at play in Asian cities contribute to an actual preference for residential densities that are higher than those that would be tolerated in countries outside of Asia. Whether higher densities are a true cultural preference in Asian countries, or whether they are merely a vestige of long-term patterns stemming from the labor-intensive, collective nature of rice-growing agrarian economies, the acceptance of higher-density living arrangements can lead to strategies for urban and regional planning that can take advantage of transportation and land-use policies that are transit-oriented. This form of development leads to higher transit use when provided, for example, in Singapore and Hong Kong. [19]

STRATEGIES FOR CONTROLLING/LIMITING AUTO USE

The anticipated rise in automobile ownership in the PRD presents a challenge to regional decision-makers. On the one hand, automobile ownership is a sign of prosperity and represents the region's emergence as a modernizing society. On the other hand, if car ownership in the PRD were to approach the levels of Germany or the United States (520 and 750 vehicles per 1,000

---

[17] Ibid. p. 36.
[18] Cascade Policy Institute, Portland, OR
[19] Jeffrey Kenworthy and Peter Newman, *Sustainability and Cities: Overcoming Automobile Dependence* (Washington, D.C: Island Press, 1999), p. 38.

inhabitants respectively),[20] it would have serious implications for land-use, urbanization, and environmental issues, particularly given the region's anticipated population increase over the next 20 years. It is true that private automobile ownership in the PRD (as in the rest of China) is low, when compared to developed countries. It is also true that there is a very strong positive correlation between rising per capita income and car ownership.[21] This correlation has been particularly strong in the megacities of Asia where the fastest rates of car ownership have been observed. One study reports that the number of motor vehicles in Shanghai tripled from 94,400 in 1985 to 272,000 in 1994.[22] Within the PRD, Hong Kong is currently the only area that has strong controls on car ownership and there are no signs, in terms of region-wide policies, to suggest that controls on ownership and/or use are forthcoming.

One assumption is that PRD leaders will, after evaluating the pros and cons of automobile ownership, seek to curb private auto use, if not ownership, in light of the environmental degradation brought on by intensive automobile use and the economic costs associated with congestion and sprawl. But this assumption may be at odds with political realities in the region. The PRD is operating within a national economy set by the Chinese government, which has established automobile production as one of its pillar industries.[23] Nevertheless, the special status of Hong Kong (as an SAR) and the PRD (as an Open Economic Region) may give regional leaders more autonomy over regional auto policy.

The negative affects of extensive automobile use on an urban region, such as road congestion, air pollution, and sprawl, have generally been tackled through initiatives that work on either the supply or demand side of the problem.[24] Supply-side measures involve efficiency improvements in the infrastructure, namely roads, highways, transit, and, most recently, ITS (intelligent transportation systems) and other "smart" transportation systems. Demand-side measures, on the

---

[20] Robert Cervero, *The Transit Metropolis: A Global Inquiry* (Washington, D.C: Island Press, 1998), p. 31.
[21] H. Dimitriou, *Transport Planning for Third World Cities* (London: Routledge and Kegan Paul, 1981) in *The Transit Metropolis: A Global Inquiry,* p.31.
[22] Q. Shen, "Urban Transportation in Shanghai, China: Problems and Planning Implications," *International Journal of Urban and Regional Research*, vol. 21, no. 4, 1997, pp. 589-606, in *The Transit Metropolis: A Global Inquiry*, p. 32.
[23] The Economist, June 8, 1996.

other hand, attempt to change commuting patterns by influencing travel behavior. They seek to reduce congestion by 1) shifting and spreading out the times that drivers use roads, 2) decreasing the number and lengths of trips in which cars by encouraging more compact development of land, 3) decreasing the number of single occupancy vehicle (SOV) trips by encouraging alternative modes (such as transit) or ride-sharing/carpooling programs, and 4) encouraging the use of alternative modes of transportation, such as transit.[25]

DEMAND-SIDE APPROACHES

The literature on demand-side approaches to traffic control and congestion relief is extensive, and the actual strategies used in any one locale vary greatly depending on the local context. These techniques, though, can be put into general categories. The following description will borrow from various sources including Cervero (The Transit Metropolis) and the Cooperative Mobility Program at the Massachusetts Institute of Technology.

One primary strategy is transportation management demand (TMD), in which the goal is to reduce congestion by reducing the overall number of SOV trips. Some TMD measures are:

Pricing parking

Charging for parking adds to the per trip cost that a driver incurs, making transit or ride sharing more economical and attractive to the SOV driver. The introduction of parking charges in seven Canadian and American cities has led to an average reduction of 19 cars driven per 100 employees.[26] But a practical problem is that most drivers have come to expect free parking, at least in the United States, and businesses would likely be hesitant to support pricing parking.

Road pricing

---

[24] Cervero, 62.
[25] Ibid. p. 62.
[26] D. Shoup, D., "The High cost of Free Parking," *Access*, no. 10, 1997, pp. 2-9 in *The Transit Metropolis: A Global Inquiry*, p. 64.

Road pricing is intended to flatten out the demand for rush-hour road space.[27] Such pricing can take several forms: congestion pricing in the form of peak- and off-peak pricing, and tolls on selected lanes of an expressway, sometimes referred to as value pricing, or HOT (high occupancy toll) lanes because this scheme gives drivers the option of staying in the general purpose lanes or paying a fee for dedicated lanes that provide superior service and time savings[28]. The administration of these pricing schemes can be greatly facilitated through electronic toll technology and other electronic pricing systems (EPS). One political problem with road pricing though is that it is regressive: it imposes a heavier burden on lower-income drivers.

Pay-as-you-drive insurance

This mechanism makes drivers cognizant of the marginal costs associated with automobile use by splitting a driver's insurance premium into two parts: a direct payment to an insurance company based on the driver's individual driving characteristics (age, residence, vehicle type, etc.) and an incremental charge payable at the fuel pump.[29] Under this mechanism, people who drive more will pay higher insurance costs.

Parking management

Zoning ordinances often inflate the number of parking spaces required for residential and commercial development. By curtailing such practices, government officials would prevent any over-supply of parking which would encourage individuals to consider alternative travel modes.[30]

HOV lanes

---

[27] James A. Dunn Jr., *Driving Forces: The Automobile, Its Enemies and the Politics of Mobility*, (Brookings Institute Press: Washington DC, 1998), p. 165.

[28] Cooperative Mobility Program, International Mobility Observatory, *Window on the World of Transportation Innovation, Center for Technology, Policy and Industrial Development*, Massachusetts Institute of Technology, June 1999.

[29] Bureau of Transportation Statistics, DOT, "Transportation Demand Management for the 1990s." Available: 15 March 2000.

[30] Cervero, p. 64.

High-occupancy vehicle lanes on highways restrict peak-hour traffic to vehicles containing two or more passengers. The purpose of HOV lanes is to encourage people to carpool by offering them lanes that are less congested than general-purpose lanes. Some evidence exists that HOV lanes reduce congestion in the short-term but fail to provide long-term benefits. The space left on general-purpose lanes by drivers attracted to HOV lanes is quickly filled up with new drivers, former public transportation users, and drivers from disbanded carpools[31].

Ridesharing/carpooling/guaranteed ride home programs

Most people are familiar with carpooling programs, where riders agree formally (through employer-sponsored programs) or informally to share driving responsibilities. The major advantages to carpooling are the shared costs of gasoline and parking, the shared responsibilities of driving, and the multiple occupants required for entrance onto HOV lanes. Guaranteed Ride Home programs provide those involved in carpooling programs with a ride home in the case of an emergency or an unanticipated long business day.

Telecommuting

Improvements in telecommunications open the door for work-at-home arrangements and would generate a number of benefits, including a reduction in highway congestion and associated wasted time commuting, reduced emission of pollutants, savings in energy and petroleum consumption, and fewer highway accidents.[32] However, it has been argued that the proponents of telecommuting underestimate the importance and value that employees place on face-to-face interactions with clients and co-workers in the workplace, thereby overestimating the impact that telecommuters will have on congestion and commuting patterns.

RESTRAINTS ON AUTOMOBILE USE AND OWNERSHIP

---

[31] Rebecca Long, "HOV Lanes in California: Are They Achieving Their Goals?," *Legislative Analyst Report*, Legislative Analyst Office, State of California, January 7, 2000. Available: http://www.lao.ca.gov/010700_hov/010700_hov_lanes.html, 17 March 2000.
[32] Ibid. p. 21.

In addition to TMD measures, governments (local, regional, and national) have taken more aggressive policies toward restricting automobile use and limiting ownership. This has been accomplished in a number of ways:

Taxes and fees

Some countries assign stiff sales taxes, import surcharges, and registration fees as a way of discouraging automobile ownership. For example, in Denmark, taxes and fees at the time of purchase roughly triple the cost of an automobile.[33] Most countries (except for the United States) place stiff taxes on gasoline as a way of making driving more expensive. High taxes on gasoline have been viewed as both a measure to raise revenue, from those who choose to pay the tax (or have no choice but to pay the tax because of poor public transportation) and a means of reducing auto use.

Area licensing schemes

This type of measure, popularized in Singapore, restricts automobile access to certain areas (in Singapore's case, certain areas of the CBD) to drivers with special licenses, purchased on a daily or monthly basis. (Recently Singapore has moved away from ALS to a full-blown electronic road pricing system.[34])

Quotas

Quota programs, seen at times in Hong Kong and Singapore, limit the total number of vehicles that can be purchased in any given year across the entire population.

Traffic bans

Traffic bans, particularly in developing countries that have a poor network of roads and limited controls on tailpipe emissions, are often imposed as emergency measures to deal with extreme air pollution. The ban could be total (no cars are allowed to enter the city), or partial (where license plate number, odd or even, or some other mechanism restricts access).

---

[33] Cervero, p. 151.

These demand-side measures work in concert with supply-side (the supply of infrastructure) elements to provide the foundation for Cervero's concept of the *Transit Metropolis*. By increasing the demand for transit services, TMD measures and auto restrictions are ways of increasing the opportunity for tighter overall integration between land-use and transportation planning. Cervero believes that "compact built forms work to produce demand levels that are sufficient to support intensive rail services, and flexible technologies work to adapt the supply of transit services to support the travel needs of spread-out areas."[35]

TRANSIT-ORIENTED DEVELOPMENT (TOD)

Transit-oriented development involves the creation of dense and well-designed mixed-use centers connected to a larger metropolitan area or extended urban region (the mega-urban region) through high-quality transit, usually rail. The objective of TOD is to decrease the number of personal trips made by automobile and, conversely, increase the number of trips taken on foot or transit. To be successful, TOD must provide housing, jobs, and commercial enterprises in a balance that generates high rates of public transportation use and pedestrian trips and low rates of automobile use.

Cervero believes that transit-oriented development will create "attractive and functional communities that are physically linked to transit stations."[36] In this particular case, Cervero was making the case for "transit villages," or centers of mixed-use development of moderate residential and commercial scale: a scale and density in keeping with American preferences for lower-density settlements. It could be argued that, given the projected population increase in the PRD, the concept of TOD would only be useful in the PRD if it supports transit developments of a much greater density than "the village." Compact and dense subcenters, connected by transit to an extended regional rail network, have been a land-use and transportation strategy used by other

---

[34] Ibid. p. 169.
[35] Ibid. p. 62.
[36] Ibid. p. 35.

metropolitan areas and regions, most notably Tokyo and Singapore, for managing growth and decentralizing urban functions. This requires tight integration of land-use and transportation planning, leading to the development of contained subcenters that generate high rates of public transportation use for shopping, recreation, and social trips. In terms of job location, Cervero has found that if jobs are concentrated in centers that are well-connected by transit, then a commuting pattern with a tremendous amount of "cross-hauling develops, with transit serving as the key link between a strand of regional centers, economically and socially dependent upon each other.[37]"

Implicit in the concept of transit-oriented development is density. If the origins and destinations of trips are thinly spread throughout a region, then those with access to cars will most likely drive rather than take mass transit.[38] There have been a number of studies that investigated the relationship between urban density and transportation. Newman and Kenworthy found that several transportation variables showed a high correlation with urban density. These include "gasoline use, car ownership, private car use, proportion of workers using private transport, public transportation per person, and the percentage of total passenger kilometers by public transport."[39] All of these variables, with the exception of the last two, showed a negative correlation with urban density. Newman and Kenworthy concluded that cities with higher urban densities had more viable public transportation systems; had less gasoline consumption per capita, and were less dependent on the private car for travel.[40]

TRANSIT AND REGIONAL FORM: THE TRANSIT METROPOLIS

Cervero investigates the impact that transportation can have on the physical form of a region or city. He examines a region that he refers to as the *transit metropolis*, or an area that "represents a built form and a mobility environment where transit is a far more respectable alternative to

---

[37] Ibid. p. 300.
[38] Ibid. p. 74.
[39] C. Tong and S. Wong, "The advantages of a high density, mixed land-use, linear urban development," *Transportation* 24: p. 296, 1997.
[40] Ibid. p. 296.

traveling than is currently the case in much of the industrialized world."[41] He acknowledges that even in a transit metropolis, automobile travel may still predominate. However, unlike auto-dependent regions, a transit metropolis captures a high transit ridership because of the quality of the transit and because of the "workable transit-land-use nexus.[42]" In other words, because transit is well-integrated into the urban form of the city or region and because it serves multi-use centers where a variety of urban functions take place, it is often a more viable commuting option than the automobile.

TYPES OF TRANSIT METROPOLISES

Cervero describes four types of transit metropolises:

Adaptive cities

These cities/regions have invested heavily in transit, particularly heavy rail, to guide growth around transit stations. In an adaptive city, transit has preceded development, making the value of land around transit stations and its development appeal greater. Some cities (like Singapore) use strong central planning to achieve their transit plans. In other cities, like Copenhagen, rail transit reflects societal values of equity and concern for the environment.

Adaptive transit

These cities/regions have already experienced decentralization and low-density development and have attempted to adapt transit to serve this type of spatial configuration. Cities have accomplished this through new technologies that make transit more flexible and technologies that bring transit closer to the rider. Other cities have a large fleet of small vehicles, mostly privately operated, that serve as feeder systems to primary transit. In all cases, the goal is to make transit a more viable option by bringing it closer to people who might otherwise drive.

---

[41] Cervero, p. 4.
[42] Ibid.

Strong-core cities

These are cities/regions where transit investments serve the purpose of maintaining the city as a regional focal point. Transit in these cities support the scale and the living patterns that residents value and prefer.

Hybrids

These are cities/regions that have attempted to guide development along transit corridors but that also operate transit in a decentralized region. Transit has been adapted to capture as much ridership as possible through paratransit (small buses and vans with greater route flexibility) and new transit technologies.

It should be noted that, although he uses the terms "adaptive *cities*" and "strong-core *cities*", Cervero makes the caveat that the connection between transit and urbanization needs to be well-coordinated across the regional level. This requires higher levels of regional coordination among government agencies responsible for land-use and transportation planning. According to Cervero, islands of transit-oriented development are not sufficient in and of themselves to create the land patterns and the densities required to generate high-levels of transit use.[43]

SUMMARY TO LITERATURE REVIEW

The literature review to date can be summarized as follows:

- Rapidly developing regions such as the PRD usually grow in uneven patterns, generally because of the lack of land-use controls that might otherwise distribute growth into designated areas.

- As regions grow, they decentralize. The density at which they do so is a key question and is usually determined by the primary mode of transportation in the region—rail or road.

Decentralization can be used as a strategy to enhance regional efficiency (through concentrated nodes of development) or it can result in an increase in sprawl, more random and incompatible land-uses, and less efficient connections between residential and commercial centers.

- Transportation plays a key role in determining the spatial form that a region assumes as it decentralizes. Rail transit is most effective at linking high-density, compact centers (resulting in a more polycentric regional form); highways tend to encourage lower-density development (resulting in a more spread-out, amorphous regional form).

- Transit facilities can be used hand-in-hand with land-use policies that encourage higher densities around transit stations, resulting in compact development, higher reliance on public transportation, and consequently, less dependence on automobile use, and opportunities for the conservation of green space and agricultural lands. Many regions have used the integration of land-use and transportation policies during their high-growth periods as a primary strategy for managing growth and the location of development, improving access to housing and urban services, relieving pressure on overly congested urban centers, and in general improving the overall efficiency of the built environment. In fact, the investment in high-capacity rail networks and the implementation of regional land-use strategies have shaped and modernized several of the world's most modern and efficient regions.

The next section will look at two transit-oriented regions that have integrated land-use and transportation planning to varying degrees, resulting in regional spatial forms that are greatly different from each other. It will be evident that the planning structures of governmental institutions, as well as the capacity of those to control land development, are the two key

[43] Ibid.

elements for integrating land-use and transportation planning. The case studies are important because, taken together, they demonstrate the magnitude of the decisions that regional leaders in the PRD face. They also serve as a looking glass into the future because how the PRD chooses to decentralize, and the transportation networks it builds to support that decentralization, will have a long-lasting impact on the region.

CASE STUDIES

The case studies of metropolitan New York City and Tokyo will be looked at from the following perspectives:

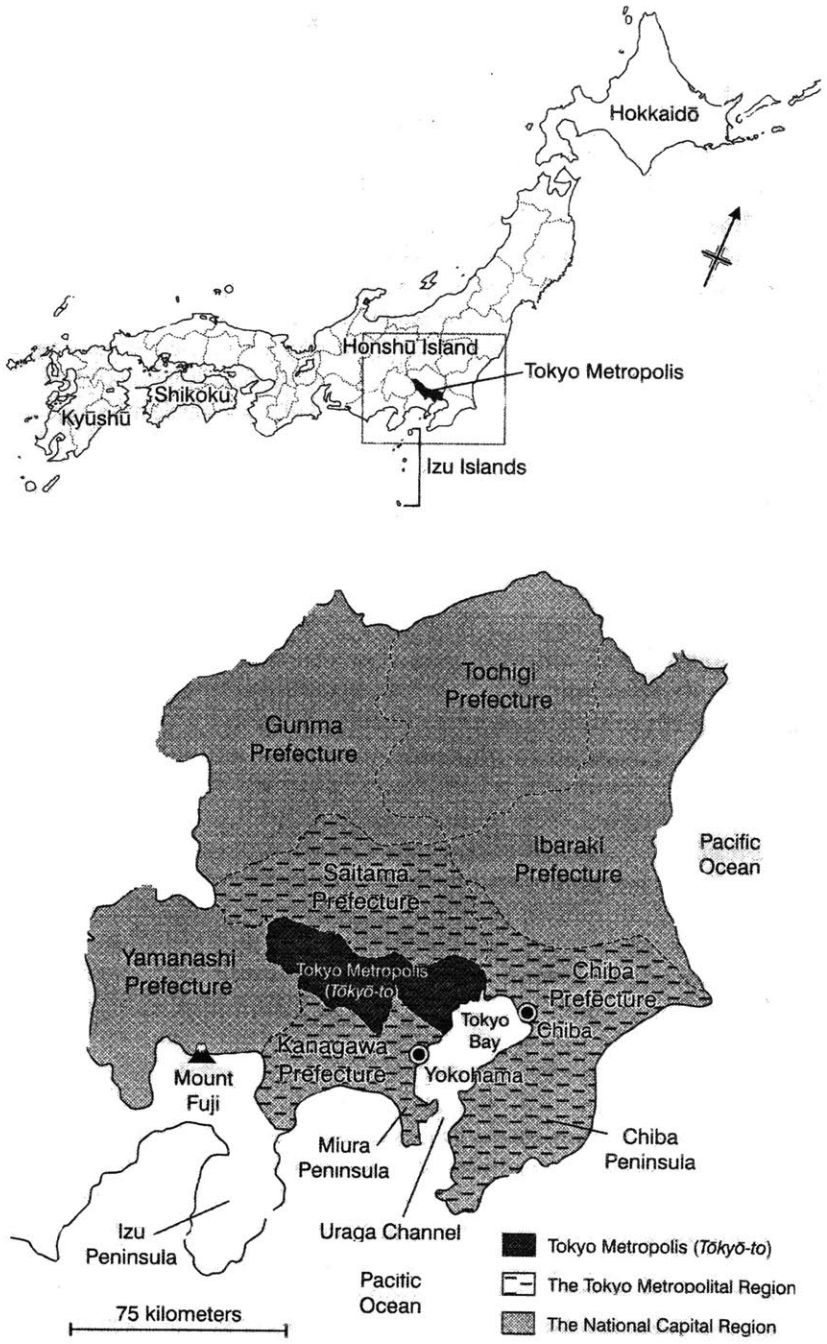
- *Geographic definition of the region:* The definition and size of the geographic region detailed in the case study.
- *Population and Distribution:* Size and areas of concentration of the region's population.
- *Overview of Transit Infrastructure:* A brief description of the characteristics of the region's transit system.
- *Regional coordination of land-use and transportation policy:* Includes identifying the leading regional institutions responsible for directing land-use and transportation planning; the use of transit-oriented development as a strategy for managing and directing regional growth, and; the identification of complementary policies to the above policies, such as those that discourage automobile use.
- *The impact of transportation decisions:* The extent to which transportation choices have affected the spatial development of the region.

TOKYO

GEOGRAPHIC DEFINITION OF TOKYO REGION

Tokyo, as a legal entity, was abolished in 1943 when the governmental functions of central Tokyo's 23 wards were consolidated with those of 40 cities, towns, and villages in the Tama District west of Tokyo. Together, the area forms Tokyo Metropolis. The Tokyo Metropolitan Government oversees the administrative and governmental functions of Tokyo Metropolis and is, in effect, a regional government.

Map 2 Tokyo Metropolitan Region *



Source: Roman Cybrinksy, Tokyo : the shogun's city at the twenty-first century

* (Yamanahsi, Gunma, Tochigi, and Ibaraki Prefectures indicated on map are outside of Tokyo Metropolitan Region)

Tokyo Metropolis and the surrounding prefectures of Kanagawa, Saitama, and Chiba comprise the Greater Tokyo Metropolitan Area, which includes the cities of Kawasaki, Yokohama, and Chiba. This research focuses on the Greater Tokyo Metropolitan Area (referred to henceforth as Greater Tokyo), an area of just over 13,000 km^2 and a population of 32 million people.

Table 2 Metropolitan Tokyo—Population and Geographic Definition (Disaggregated)

Metropolitan Definition	Zone*	Area in km^2	Estimated 1995 Population
Tokyo CBD (with 3 of the 23 central wards)	**1**	**42**	**244,000**
Central Tokyo (remaining 20 of the 23 central wards)	**2**	**575**	**7,724,000**
Tokyo Metropolis	**3**	**1,160**	**3,806,000**
Greater Tokyo Metropolitan Region	**4**	**11,366**	**20,803,000**
Total (all zones combined)		**13,143**	**32,577,000**

Source: *Four World Cities Transport Study*

* In order to simplify discussion, and to make relative comparisons with other case studies, zones have been identified for each region. A zone is based upon the level of urbanization and in relation to the region's CBD. These zones are borrowed from the Four World Cities Transport Study.

POPULATION AND DISTRIBUTION

Over the last 20 years, Zones 1 and 2 have been losing population to Zones 3 and 4, resulting in a dense, highly developed and sprawling metropolitan region extending 50 km from the center of Tokyo. Zone 1, in particular, has seen a substantial decrease in its population over the past two decades as commercial development in the central wards has "out-priced and displaced homes" leaving all but the very wealthy shut out of the Central Tokyo housing market.[44]

The need to provide housing for a growing population has been a recurring theme in the expansion of the Tokyo metropolitan region. After World War II, as well as during a period of dramatic economic growth in the 1960's when Tokyo's population grew by 600,000 people

[44] London Research Centre, Four World Cities Transport Study, (London: London Research Centre Stationery

annually, housing has been the primary catalyst for regional growth. During both periods, the enormous demand for housing could only be met through the construction of new towns in suburban areas—development that gradually pushed the border of the metropolitan region further and further out from central Tokyo.[45] The first few waves of suburbanization generally took place southwest of Tokyo in the Tama District (Zone 3). Today, the areas adjacent to the Tama District—namely the prefectures of Chiba, Saitama, and Kanagawa (all Zone 4)—are experiencing the most rapid growth in population and development.[46]

OVERVIEW OF TRANSIT INFRASTRUCTURE

The demand for public transportation in Greater Tokyo is enormous, particularly from suburban areas into Central Tokyo where a significant percentage of the region's 8.3 million jobs are located. The Tokyo region's 14 subway lines carry more than 3 billion passengers per year, while its eight suburban rail lines carry more than 4.8 billion riders annually.[47] The dominance of rail as the primary mode of transit is evident from the following statistic: 96.1% of all passenger transit kilometers in Greater Tokyo is conducted on the region's rail network.[48] In fact, Greater Tokyo's rail network in Zones 3 and 4 is by far the largest and most extensive network of any urbanized region in the world.[49] By linking transit to satellite new towns, national and regional officials have created the densest, and most extensively used, rail network in the world.

Office, 1998), p. 84.

[45] Michael Wegener, "Tokyo's land market and it impact on housing and urban life," *Planning for Cities and Regions in Japan,* ed. Philip Shapira, Ian Masser and David W. Edgington (London: Liverpool University Press, 1994), p. 95.

[46] Michael Hebbert, "Sen-biki amidst Desakota: Urban Sprawl and Urban Planning in Japan," *Planning for Cities and Regions in Japan*, ed. Philip Shapira, Ian Masser and David W. Edgington, (London: Liverpool University Press, 1994) p. 75.

[47] Cervero, p. 190.

[48] Kenworthy and Newman, p. 83.

[49] London Research Centre, p. 47.

Table 3 Route Length of Metro and Regional Rail Service by Zone—Tokyo Region

Metropolitan Definition	Zone	Area in km^2	Route Length of Metro Service (km)	Route Length of Regional Rail Service (km)	Total
Tokyo CBD (with 3 of the 23 central wards)	**1**	**42**	**84**	**25**	**109**
Central Tokyo (remaining 20 of the 23 central wards)	**2**	**575**	**134**	**382**	**516**
Tokyo Metropolis	**3**	**1,160**	**0**	**298**	**298**
Greater Tokyo Metropolitan Region	**4**	**11,366**	**45**	**2,160**	**2,205**
Total (all zones combined)		**13,143**	**263**	**2,865**	**3,128**

Source: *Four World Cities Transport Study*

REGIONAL COORDINATION OF LAND-USE AND TRANSPORTATION PLANNING

Land-use and transportation planning are tightly integrated in Japan. It could be argued that the need for considering both at the same time is essential to the proper functioning of the country's dense urban areas. The national government plays a significant role in regional land-use and transportation planning and policy. According to the Four World report, planning in Japan is "based on shared powers and responsibilities amongst the national ministries, the local governments and the private sector."[50] This multi-tiered planning system results in a complex set of planning requirements and legislative controls. Since a great deal of the policy-making is developed at the national and regional levels of government, an abridged description of these planning functions follows:

National level: Japan periodically sets national planning objectives in the *Comprehensive National Development Plan*, a long-term land-use structure plan developed by the National Land Agency. The Prime Minister of Japan initiates action on the plan with the cooperation of key

[50] Ibid. p. 33.

ministries involved in transportation, construction, labor, and the environment.[51] To date, there have been five national plans, the latest released in 1998 (the *New Comprehensive National Development Plan Grand Design for the 21st Century).* In effect, these plans establish national planning policies and directives that are implemented, with federal oversight, by regional and local governments. It should be noted that beginning in 2001, the Ministry of National Land and Transport will be formed from the Ministry of Transport, the Ministry of Construction, the National Land Agency, and several other smaller ministries.[52] Although a review of the literature did not provide any immediate explanations for the consolidation, the move does appear to elevate the national commitment to coordinated land-use and transportation planning.

It is important to note the emphasis placed on regional cooperation in the National Development Plan. All sections of the document calls for municipalities to develop regional planning initiatives and other cooperative approaches for building infrastructure and for providing public services. For example, consider the following strategy recommended by the plan:

> "Municipalities that have different characteristics will mutually cooperate widely even beyond prefectural boundaries to develop independent and dynamic regional communities. These 'regional cooperation corridors' will form in range with each other throughout the country. In the regional cooperation corridors, each of the municipalities will share regional resources and attractive features widely, and share roles based on cooperation that they see fit.
>
> Transportation and information and communications infrastructures in the regional cooperation corridors will form the basis for active exchange of people, materials, and information. Cultural, industrial and other activities will be conducted widely, beyond the ordinary living areas, giving people more options in their lives. Inter-regional cooperation will promote efficient locating and effective use of various facilities among regions. In addition, tourism and other regional industries will be promoted and active regional communities will be formed. The regional cooperation corridors will provide space in which each region, with its different history and culture, can cooperate and conduct exchanges to enhance recognition of

[51] Hari Srinivas, Japan Urban Observatory, Tokyo Institute of Technology. Available: http://www.soc.titech.ac.jp.uem.observatory/jp-ovewview.html, 8 March 2000.
[52] Ibid.

> the unique characteristics of the region and to create new cultural experiences and values."[53]

Regional level: The Tokyo Metropolitan Government (TMG) is responsible for carrying out the regional land-use and transportation initiatives outlined in the National Capital Regional Basic Plan, as well as implementing national policies outlined in the National Development Plan. However, all transport and land-use policies carried out by the TMG must conform to national government guidelines, rules, and regulations.[54] Within the TMG, the Bureau of City Planning formulates all transportation plans. It also plays a "key role in the coordination of transportation planning and operations between the TMG and the wards, cities, towns and villages in the metropolitan areas."[55]

Private sector involvement in planning: The private sector has been instrumental in the development of Greater Tokyo. In fact, the majority of the rail infrastructure built in the past 50 years in the Tokyo region has been financed and constructed by private rail companies. In general, rail companies laid track on land that they had acquired in what were, at the time of purchase, rural areas outside of Tokyo. The companies then developed land near stations, constructing, and then selling or leasing, department stores, housing, office buildings, supermarkets, theaters, and other facilities that would attract residents and transit riders. By increasing the accessibility to their properties, the companies made considerable profits as land values appreciated. This basic structure of developing real estate in conjunction with rail infrastructure is still present in Tokyo. The national government recognizes the economic and social benefits of rail service and regulates the fares that rail companies can charge. The rail companies in turn are allowed to maximize their real estate holdings along their transit lines.

TRANSIT-ORIENTED DEVELOPMENT

The co-development of rail and mixed-use development has been the guiding principle of regional development in Greater Tokyo, supported by national policy interests that recognized

---

[53] Japanese Land Agency, *Comprehensive National Development Plan Grand Design for the 21st Century*, 1998
[54] Ibid.

the need for a more systematic mechanism for metropolitan growth, and undertaken by a private sector driven by the profit motive.[56] In fact, in many of the suburbs west of Tokyo entire communities are the "domains of powerful conglomerates that are known best for their department store chains, but that first and foremost are in the business of railway and real estate development."[57] Placing shopping malls, businesses, entertainment complexes, and housing near rail stations generated rail traffic, created destinations, and in turn brought customers to these centers. The fact that this type of development was done throughout the region, along each of the regions commuter rail lines, has contributed to the incredibly high rate of rail use found in Greater Tokyo.

AUTOMOBILE POLICIES

Because of Japan's land constraints, and the country's reliance on imported oil, the government tries to limit the demand for car ownership through policies that make the cost of car ownership extremely high. These include a vehicle acquisition tax; an annual registration tax, which includes a surcharge based on the weight of the vehicle; and garaging requirements that require anyone registering a car to verify the existence of an off-street parking space at his or her residence.[58] The government has also implemented policies that make car use more costly (i.e. policies that increase the daily out-of-pocket cost of using a car). These include a steep gasoline tax (four times that of the United States) and tolls on interurban expressways.[59] At the same time, the government promotes transit use. All Japanese workers receive a tax-free monthly commuting allowance as high as US$500. This benefit covers full transit commuting costs borne by a worker. However a worker who commutes by automobile receives only 15% of this amount, based on distance traveled.[60] These policies have kept car ownership rates in greater Tokyo relatively low for a region with such a high per capital income (US$30,000 in 1997). For example, in 1990 there were 275 automobiles per 1,000 inhabitants in greater Tokyo, below

---

[55] London Research Centre, p. 67.
[56] Cervero, p. 181.
[57] Ibid. p. 189.
[58] Ibid. p. 187.
[59] Ibid. p. 187.
[60] Ibid. p. 188.

greater London's rate of 350, and well below the 750 found in most U.S. cities. Overall, the metropolitan region averages 460 annual transit trips per capita, one of the highest in the world, and well above the 180 transit trips per capita for the U.S.'s most transit-intensive region, namely metropolitan New York City.

THE IMPACT OF TRANSPORTATION DECISIONS

Unlike the uneven spatial growth many mega-urban regions, Tokyo's expansion has been more even and systematic. Over the last 30 years, even though the metropolitan area has expanded very quickly and very densely, Tokyo has managed to avoid the gaps in development that so often characterizes fast-growing regions. This is due, in great part, to the region's rail network that supported the expansion of the region very well.[61]

At first glance, the settlement patterns in Greater Tokyo contradict the literature review just presented. How could an area be sprawling and decentralized, while at the same time, so reliant on public transit for both work and non-work trips? Isn't sprawl usually the outcome of auto-dependent growth? The answers to both these questions reside in the choices made around decentralization—specifically, decisions concerning the densities at which regions decentralize and the transportation modes that best serve these densities. The dominance of rail transit in Greater Tokyo has allowed the region to decentralize, along the rail routes, at relatively high densities. So, while there is considerable sprawl, there are also dense concentrations of development around rail stations.

Interestingly, residential densities in Tokyo's Zone 1 are relatively low compared to other regions. This is due to the population shift from Zone 1 to outlying zones previously described. However, Greater Tokyo maintains higher densities in Zones 2-4 when compared to other regions. This can be seen in the following chart:

---

[61] Mamoru Taniguchi, "Environmental Amenity in Growing Mega-City—Tokyo as Blend of East and West," *East West Perspectives on 21st Century Urban Development*, ed. John Brotchie, Peter Newton, Peter Hall, John Dickey, (Aldershot: Ashgate Publishing, 1999), p. 266.

Table 4 Residential population density 1990/91 (persons per km^2 per zone—disaggregated)

	London	New York	Paris*	Tokyo
Zone 1	**6,940**	**23,610**	**21,450**	**6,330**
Zone 2	**4,300**	**9,470**	**4,020**	**13,740**
Zone 3	**540**	**1,200**	**190**	**3,180**
Zone 4	**350**	**230**	**-**	**1,750**

Source: *Four World Cities Transport Study*
Paris, because of its compact regional development, does not have a Zone 4.

The concentration of the population in the zones is equally important when determining the impact of density on travel behavior. In Tokyo, the population in Zones 2-4 is concentrated in urban or semi-urban areas containing mixed land-uses. This type of settlement patterns fosters walking trips and the use of public transport.[62] The regional rail network helps to create and then supports these settlement patterns.

NEW YORK CITY

GEOGRAPHIC DEFINITION OF NEW YORK CITY REGION

The New York City metropolitan region spreads across four states and totals just over 33,000 km^2. The region's center, New York City, consists of five boroughs: Manhattan, the Bronx, Queens, Brooklyn, and Staten Island. Manhattan, due to its concentration of commercial, media, and cultural activities, is New York's most famous borough. Brooklyn and Queens lie east of Manhattan across the East River; the Bronx lies north across the Harlem River; and Staten Island lies southwest in New York Harbor. Together, the boroughs cover a land area of 799.5 km^2 and have a population of 7.5 million.

A large portion of the metropolitan region extends past the geographical boundaries of New York City. Long Island extends 118 km east of Manhattan and is home to more than 6 million people. The bulk of Long Island's population is concentrated in Brooklyn and Queens, but densely settled suburbs also extend beyond those two boroughs along the narrow width of the island.

[62] London Research Centre, p.82.

Northern New Jersey, west of Manhattan across the Hudson River, contains the industrial and urban areas of Newark, Jersey City, Paterson, and Elizabeth (all located on or near the Hudson River or New York Harbor) and more suburban regions further west. To the north of the Bronx lies the city of Yonkers and beyond that the suburban and semi-rural counties of Westchester, Putnam, Rockland, and Orange in New York State and Fairfield and New Haven in Connecticut.

Table 5 Metropolitan New York City—Population and Geographic Definition (Disaggregated)

Metropolitan Definition	Zone	Area in km^2	Estimated 1995 Population
Manhattan	**1**	**23**	**544,000**
Brooklyn, Bronx, Queens, Staten Island, small section of Northern New Jersey	**2**	**734**	**6,989,000**
Rockland, Westchester Counties in New York State; extended area of Northern New Jersey	**3**	**5,036**	**6,140,000**
Remaining areas within the 26-county Tri-State Region (New York, New Jersey, Connecticut)	**4**	**27,372**	**6,524,000**
Total (all zones combined)		**33,165**	**20,197,000**

Source: *Four World Cities Transport Study*

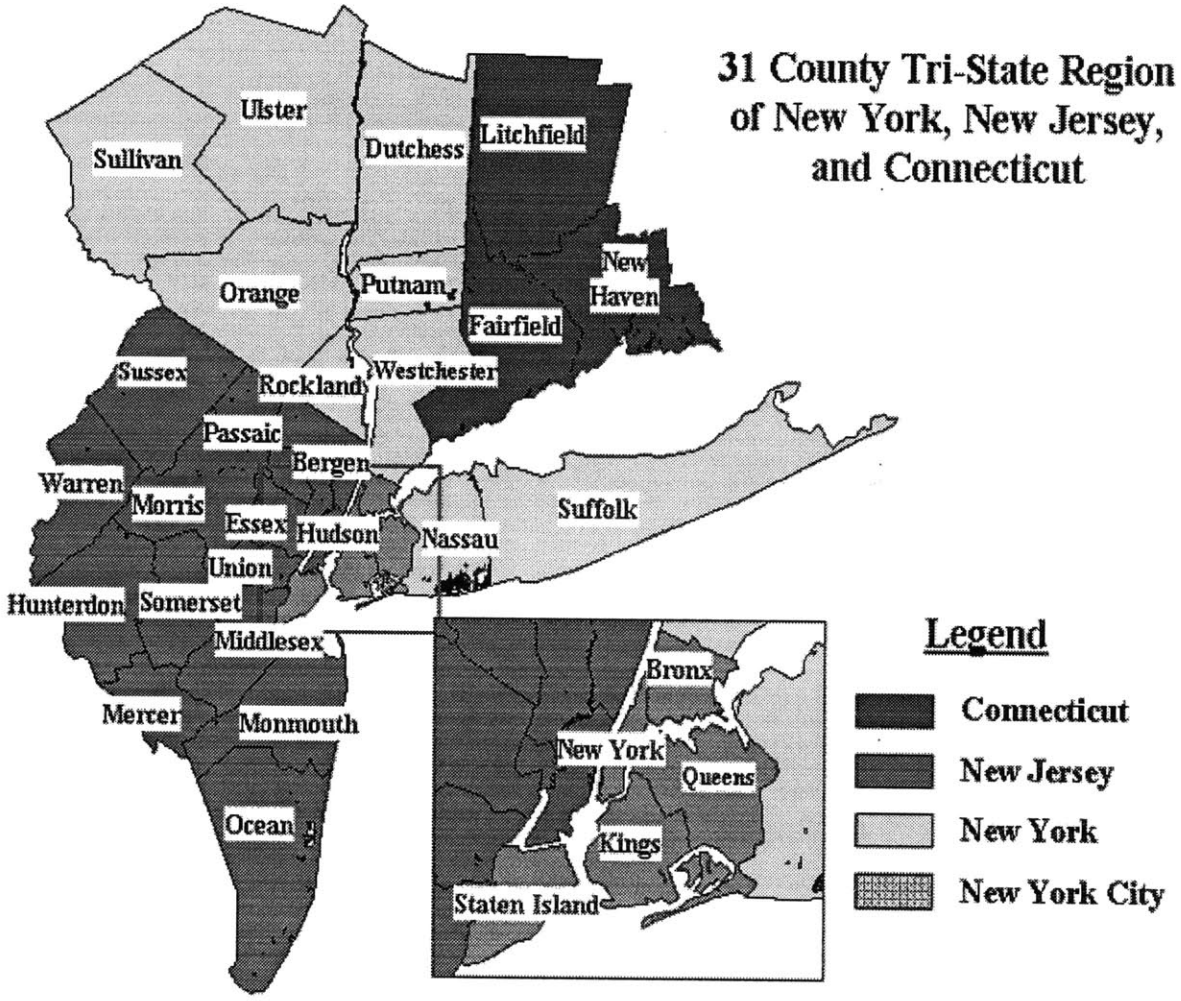
POPULATION AND DISTRIBUTION

The population of the metropolitan New York City region has increased slightly over the past decade, averaging only 0.3 percent growth per year, below the 1.0 percent growth experienced by the rest of the country. However, different areas of the region have experienced different rates of growth and decline. Zones 1 and 2 have been losing residents, with an estimated one million people moving out of the area between 1990 and 1997. Meanwhile, zones 3 and 4 have gained population, often at rates greater than the national average. The overall region has experienced significant levels of sprawl. Consider that between 1960 and 1985, the urbanized land surrounding New York City increased by 65% while the total population of the region grew by only 8 percent.[63] The exodus of the population from Zones 1 and 2 (from the urban core) has not been unique to New York City. Most other American cities have lost population to the suburbs,

[63] Dunn, p. 147.

or are experiencing much smaller rates of growth than the suburbs. There are a number of factors causing this migration, not the least of which is the supportive environment for the automobile in American society.

Map 3 New York City Metropolitan Region



Source: *Konheim & Ketcham*

OVERVIEW OF TRANSIT INFRASTRUCTURE

The public transportation system in the region is the nation's most extensive and heavily used. The three major transit providers—the MTA (Metropolitan Transit Authority), the Port Authority of NY/NJ, and New Jersey Transit—carry almost two-thirds of the *country's* annual rail riders. The region leads the United States in per capita public transportation usage and is last in the nation among urbanized areas in automobile ownership and vehicle-miles traveled per capita. Nearly 50% of workers use public transportation to travel to their jobs, while 30% drive by themselves, the lowest drive-alone rate among the country's urbanized areas.

The MTA is the country's largest public transportation company, carrying nearly 6.5 million passengers daily on its subway, commuter rail, and bus lines. PATH trains (Port Authority Trans-Hudson) carry 70% of the rail commuters entering Manhattan from New Jersey, while New Jersey Transit serves the cities and suburbs of northern New Jersey with its commuter rail network. Because of the concentration of population and economic activity, the region relies on rail and mass transit more than any other region in the United States. The major transit service providers noted above are all public agencies. Many small (relative to the major providers, in terms of budget and fleet) private bus companies also serve the region.

Table 6 Route Length of Metro and Regional Rail Service by Zone—New York City Region

Metropolitan Definition	Zone	Area in km^2	Route Length of Metro Service (km)	Route Length of Regional Rail Service (km)	Total
Manhattan	**1**	**23**	**73**	**7**	**80**
Brooklyn, Bronx, Queens, Staten Island, small section of Northern New Jersey	**2**	**734**	**317**	**160**	**477**
Rockland, Westchester Counties in New York State; extended area of Northern New Jersey	**3**	**5,036**	**30**	**558**	**588**
Remaining areas within the 26-county Tri-State Region (New York, New Jersey, Connecticut)	**4**	**27,372**	**0**	**877**	**877**
Total		**33,165**	**420**	**1,602**	**2,022**

Source: *Four World Cities Transport Study*

REGIONAL INTEGRATION OF TRANSPORTATION AND LAND USE

Transportation and land-use planning are not tightly integrated in the New York City region. Transportation planning involves a complex funding and reporting arrangement between federal, state, and municipal government; land-use decisions are, for the most part, the domain of the local planning board. Between the two, there are separate planning processes, and under this institutional and funding arrangement they do not naturally flow together.

With regard to transportation planning, decision-making organizations are concentrated at the state or sub-regional level and, although the federal Department of Transportation (DOT) is the primary provider of funds for transportation projects in the U.S., the planning process is ceded to the states.[64] That said, federal funds do come attached with environmental mandates and the recipients of these funds, whether a state government or a private entity, must adhere to federal

[64] London Research Centre, p. 48.

environmental guidelines. At the state level, the governor generally sets the transportation planning policies and priorities in conjunction with state transportation departments and public transportation authorities. Federal law requires that municipal input into state and regional priorities, and this has a great impact on decision-making at the state level.

Land-use planning in the region, on the other hand, is generally conducted at the municipal level, and although both New Jersey and Connecticut have recently implemented state land-use plans, municipalities there still remain fiercely protective of their right to control the use of local. In fact, planning departments in these states have been reluctant to enforce state land-use regulations because of the seemingly ever-present tension between the municipality (with localized land-use objectives) and the state (with broader planning objectives). Often, enforcement leads to controversy, and on controversial projects, the decisions ultimately turn political, ignoring carefully produced statewide plans.[65]

The following passage highlights the complexity of planning in metropolitan New York City:

> "The New York metropolitan region has more than 700 local governments with zoning authority, not to mention three separate state governments, more that thirty county governments, and hundreds of special purpose districts, independent authorities, and boards with the power to levy some kind of property tax or travel toll."[66]

Countering these top-down institutional structures is the concept of municipal self-determination, often referred to as "home rule," which is widespread in the region and protected passionately by the citizenry, particularly on issues involving property rights and land use. In this way, the New York City metropolitan region is no different from other regions of the country. In the U. S., states are constitutionally empowered to oversee the administration of local government. Yet nearly all states have followed the public's demand for a home-rule governmental structure and have turned over most decision-making to municipalities.[67] The results of home rule in the

---

[65] Ibid. p. 56.
[66] Dunn, p. 147.
[67] Jon C. Teaford, *The Unheralded Triumph. City Government in America, 1870 – 1900*, (Baltimore: Johns Hopkins University Press, 1984), p. 103.

United States, according to James Wesley Scott, has been the "fragmentation—or balkanization—of land-use decisions in metropolitan areas[68]." Scott continues:

> "Effective long-term regional planning, or even the establishment of other forms of metropolitan administration have rarely been formally institutionalized in the United States. Territorial reforms at rationalizing service areas and incorporating suburban areas within the jurisdictions of central cities have never been coerced. As a result, except for a short period before the 1920s, large-scale annexations of sovereign municipalities remains a political impossibility."[69]

Despite this apprehension about regional forms of government, the residents of metropolitan New York City do accept regional authorities with very specific missions, such as providing transportation infrastructure, and as long as they have limited jurisdiction over local land-use policies. The two most notable—the Metropolitan Transit Authority (MTA) and the Port Authority of New York/New Jersey—supply and maintain the transportation infrastructure for the metropolitan region.

Transportation planning, because it involves the coordination of large-scale infrastructure development across city and state lines, has taken on a more regional perspective. However, it should be pointed out that regional coordination around transportation issues, because of the number of governmental entities involved, is an extremely difficult to achieve. Although the Port Authority has had success in obtaining regional consensus on placement and development of infrastructure, the area lacks overall regional coordination on transportation, according to the May 1996 *Enhanced Planning Review of the New York City Metropolitan Area*:

> "...there is currently no formal mechanism for coordinated regional decision making through which to address regional transportation concerns including congestion, goods movement, and air quality. In lieu of a formal mechanism, current efforts led by various agencies have attempted to address these issues on an ad-hoc basis.[70]"

---

[68] James Wesley Scott, *Challenge of the Regional City, (*Berlin: Dietrich Reimer, 1992), p. 26.
[69] Ibid., pg. 26.
[70] US Department of Transportation, Federal Transit Authority, *Enhanced Planning Review of the New York City Metropolitan Area.* Available: http://www.fta.dot.gov/ntl/index/html, 17 March 2000.

The literature on transportation funding mechanisms, planning and reporting requirements, and the various roles of federal, state, and local governments is extensive and not entirely relevant to this research. The salient points to this thesis are:

- Transportation planning in the New York City metropolitan region is complex because it involves so many levels of government.
- Transportation planning has become politicized because of the number of governmental players in the decision-making. Because of this, the most visible planning institutions are used as "political footballs." For example, New York City Mayor Rudolph Giuliani has sued the Port Authority several times, contending that a disproportionate amount of the agency's budget is devoted to projects in New Jersey.[71] However, a report by the Taub Urban Research Center maintains that Port Authority capital spending has generally been well-balanced between the two states.[72]
- The "regional" transportation planning agencies are not entirely regional. The MTA runs service in New York State and Connecticut, but not in New Jersey. The Port Authority's mission is to promote commerce of the "bi-state port"[73] (of New York and New Jersey) but excludes Connecticut.

TRANSIT-ORIENTED DEVELOPMENT

Like Tokyo, the New York City region developed around its rail system. And like Tokyo, New York's early rail networks were built by private companies that packaged transit investments with real estate projects and land development.[74] Undoubtedly, the population and development densities achieved in Manhattan (Zone 1) and the other New York City boroughs (Zones 2) has only been possible because of the zones' dense subway (metro) network. In this context, the New York City region has extensively used transit-oriented development (and redevelopment).

---

[71] Editorial, "Priorities at the Port Authority, " The New York Times, 7 February 1996, pg. 18.
[72]Hugh O'Neill and Kathryn Garcia, "Managing New York's Capital Crunch," (New York University, Taub Urban Research Center, September 1996.)
[73] London Research Centre, p. 53.
[74] Cervero, p. 181.

However, most of this rail-based development took place in the first half of the century during a period when the region's population was both growing and decentralizing. Today, planners in the New York City region must contend with the trend of down-zoning around transit stations, which in effect limits the density of development allowed around a transit station.

AUTOMOBILE POLICIES

The cost of owning and operating a car in metropolitan New York City is more expensive than in other parts of the United States but still low when compared to other major world cities. Gasoline prices are relatively low in the U.S. (the retail price of gasoline, including taxes, fell by 7% between 1980 and 1993 in real dollar terms) and parking for motorists is free 99% of the time they make a trip.[75] Even when parking is not free, the U.S. federal tax code allows companies to give employees a nontaxable fringe benefit of up to $150 a month for the cost of parking[76]. Automobile policies that increase the cost of car ownership and use are politically very unpopular in the U.S., and the New York City region is no exception. Efforts to reduce congestion have been directed toward ITS (Intelligent Transportation Systems) and electronic pricing systems on toll roads in the region.

THE IMPACT OF TRANSPORTATION DECISIONS

The New York City region has been shaped by "two sustained waves of region-building."[77] In the first half of the 20th century, growth took place along the region's rail network. During this period, the population grew quickly but the physical form of the region expanded slowly. The primary mode of transportation at the time—rail—kept the region relatively compact. The second wave of region-building took place in the 1950s, 60s, and 70s and was driven by the automobile and the development of the region's highway network. Unlike the compact growth seen during

---

[75] Ibid. p. 34.
[76] Regional Plan Association, *A Region at Risk*, (Washington, DC: Island Press, 1996), p. 155.
[77] Ibid. pg. 15.

the railway expansion, the highways and the growing rates of automobile ownership greatly expanded the physical boundaries of the region.[78]

REGIONAL COMPARISON

Both New York City and Tokyo developed around their rail networks, however only one—Tokyo—has continued to use rail transit and TOD as a tool for directing regional growth and managing decentralization. This has resulted in a regional land pattern that is compact—where jobs, housing and services are organized in subcenters around rail stations. In contrast, the New York City region has decentralized at a much lower density. The extreme densities in the urban centers trail off into much lower densities, more quickly, when compared to Tokyo.

The following indicators illustrate the difference in spatial form between the two regions and reflect each region's transportation investment priorities.

[78] Ibid. pg. 15.

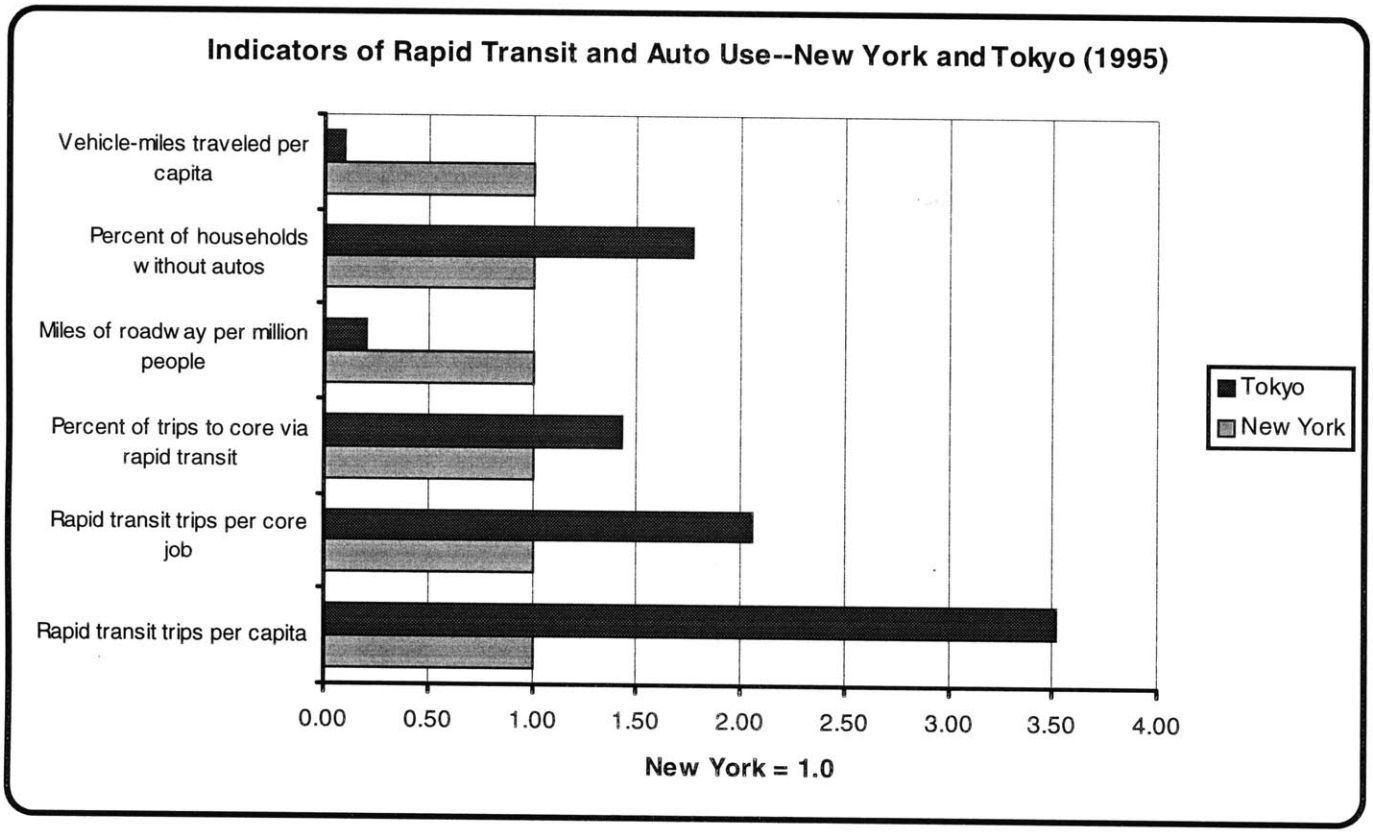


Figure 1 Indicators of Rapid Transit Use—New York City and Tokyo

Source: *Citizen's Budget Commission, Inc. (New York)*

Figure 1 reveals the reliance on transportation mode—car and rail—in each region. The impact of Tokyo's investment in passenger rail infrastructure is evident: transit trips per capita are three times those in New York; twice as many trips into Zone 1 by rail; and lower rates of car ownership, roadway infrastructure per capita, and vehicle-miles-traveled.

Table 7. Employment and Employment Density in Tokyo and New York, 1990

	Employment	Area (sq. mi.)	Employ. Per Sq. Mile	All Modes	Entries by Auto	Auto Percent	Entries per Sq. Mile	Auto Entries per Sq. Mile
Tokyo	**7,393,000**	**238.0**	**31,063**	**NA**	**NA**	**NA**	**NA**	**NA**
Tokyo CBD	**2,381,000**	**16.1**	**147,888**	**2,990,000**	**330,000**	**11.0**	**18,571,429**	**2,049,000**
New York	**3,505,000**	**347.0**	**10,102**	**NA**	**NA**	**NA**	**NA**	**NA**
New York CBD	**1,967,000**	**29.0**	**218,556**	**3,185,000**	**1,030,000**	**32.3**	**35,388,889**	**11,444,444**

Source: *Citizen's Budget Commission, Inc. (New York)*

Table 7 shows the employment densities of both the New York City and Tokyo CBDs. Employment is heavily concentrated in the center of Tokyo and New York City—the dominant urban center of each region—however people are three times more likely to travel into New York City by car than in Tokyo.

Table 8. Highway Systems Characteristics for Two Regions, 1995

Region	Miles of roadway	Miles of roadway per million people	Daily VMT (thousands)	Daily VMT per mile of roadway	Daily VMT per capita
New York	**37,066**	**2,278**	**238,625**	**6,438**	**14.7**
Tokyo	**14,515**	**456**	**44,620**	**3,074**	**1.4**

Source: *Citizen's Budget Commission, Inc. (New York)*

Table 8 compares the highway systems and their usage in the New York City and Tokyo regions. The population of the New York City region is more spread out, requiring a greater supply of roads. Individuals in metro New York City drive 10 times more than their counterparts in metro Tokyo.

Table 9. Annual Transit Capital Investment--New York and Tokyo (1995)

City	Rail transit investment (billions of $)		Rail transit investment (per capita)		Ratio of Rail to highway investment per capita
New York	$	1.57	$	81	1.12
Tokyo	$	16.25	$	511	1.29

Source: *Citizen's Budget Commission, Inc. (New York)*

Table 9 shows that the high level of rail service enjoyed by Tokyo comes at a steep price. The incredibly high investment rate (when compared to New York City) comes from both the amount of infrastructure and the cost of land acquisition.

RECOMMENDATIONS

The case studies and the literature reviews were presented to underscore the importance of land-use and transportation planning decision on regional growth and spatial development. As the PRD grows and develops, and as the region becomes increasingly urbanized, a strategic decision centering on transportation infrastructure—specifically, the balance between rail and road investments (thereby setting transportation priorities)—becomes one of the most important planning decisions facing PRD leaders.

PRD leaders should restructure the region's multi-tiered government into a regional government.

One of the major challenges facing PRD decision-makers is how best to plan, manage, control, and govern the growth and development of the region. A key question is whether the provincial, county, and municipal governments in the region have the administrative capacity to govern effectively from a regional perspective. This statement should not be taken as a criticism of these governments, although it is intended to be provocative. If leaders in the region agree that the PRD in the year 2020 should be cleaner, richer, productive, and competitive, then they need to consider the type of governance that is most likely to steer the region toward obtaining those

objectives. The pros and cons of a PRD regional government should be seriously examined. Consider the efficiency of the current governmental structure:

> "Another [difficulty for planning] is the lack of regional cooperation in local planning and development. The shift of economic responsibilities to the cities and enterprises has led to local protectionism. As enterprises are a major source of government revenue, city governments are keen to ensure the survival of these economic entities by discouraging the trading of goods from other places. Many cities compete among themselves and try to provide large scale or higher grade infrastructure to attract foreign investment. This leads to uncoordinated urban and regional infrastructure development and waste of resources. Such a lack of coordination can be seen in the development of duplicated airports, ports and the incompatibility of road construction standards between cities."[79]

PRD municipalities, rather than competing against one another, should develop cooperative strategies for competing against their long-term rivals—Shanghai, Singapore, Jakarta, and other South Asian mega-regions. Further, if the PRD wants to attract international investment, then it must recognize that its "comparative advantage has shifted from a basis in natural resources and past industrial histories to a new focus on 'created assets.'"[80] These created assets include "reliable electricity and water supplies, diverse labor supply, and transportation infrastructure to higher order functions such as hospitals and universities, parks and amenities."[81]. A coordinated effort is needed to develop, supply, and market these created assets to investors—an effort that would be most efficiently led by a regional government.

A proposal for a PRD regional government is, admittedly, very controversial and one that is most likely to be considered untenable by parties in the PRD, both inside and outside of Hong Kong. Opposition to such a proposal, however, would likely be on political grounds, not on grounds that a regional form of government would be inefficient. In fact, a regional government, if devised properly, would best serve the long-term physical and social development of the PRD.

---

[79] Ming Zhang

[80] Mike Douglass, "East Asian Urbanization: Patterns, Problems, and Prospects", Asia/Pacific Research Center, Stanford University, July 1998.

[81] Ibid.

The challenge then to PRD decision-makers would be to devise a regional structure that is responsive, effective, transparent, and accountable to the citizenry.

PRD leaders should integrate land-use and transportation planning processes.

A regional form of government opens the door for another recommendation: devise a system for integrating land-use and transportation planning. This concept has been identified throughout the thesis as an important strategy for managing regional growth. By developing institutional capacity that centers on land-use and transportation planning at the regional level, the PRD could integrate the two planning processes to achieve a comprehensive and coherent policy that encompasses the different transportation modes. There are advantages of this type of institutional arrangement:

> "Responsibilities are explicitly and clearly located, with the local responsibility for execution of functions accompanied by an adequate system of accountability and incentives for efficient performance. Traditional rivalries (among land use, public transport, road and traffic enforcement) are confronted, often by the creation of multi-modal, multi-functional Urban Transport Authorities."[82]

Because the PRD is growing so rapidly, and its urban areas are decentralizing, it is critical that decision-makers develop a regional authority that is organized to look at both transportation and land-use planning issues concurrently. Under such an institutional structure, both planning processes would be coordinated, leading to an increased capacity to develop and implement long-range planning objectives. And by linking the expansion of transport facilities to regional land-use objectives, the PRD can manage its decentralization in a manner similar to Tokyo, that is, without gaps in development and with more efficient land allocation and uses on the periphery of urban areas.

With regards to Tokyo, PRD leaders should note the dominant planning issue in Tokyo today: How should central Tokyo (Zone 1) decentralize its intense level of urban functions? The

[82] The World Bank, "Transport in the City of Tomorrow: The Transport Dialogue at Habitat II." Available:

recommendations of the National Land Agency to address this issue would not be possible without the transportation and land-use decisions made decades ago. In order to reduce congestion on the region's rail networks, planners are promoting both the dispersion of office and commercial enterprises to sub-centers in Zone 2 and the development of new business core cities in Zones 3 and 4.[83] This restructuring of urban functions is only possible because the system's rail network is adaptable. Densities can be increased to accommodate new growth and to accept redistributed activities, all while maintaining strong regional connections to the core cities. Such a planning effort would be difficult in metropolitan New York City. The preference for lower densities in Zones 2-4 is reflected in zoning laws that prohibit high densities around transit stations, leaving new or redistributed activities to venture even farther out into the region.

The decision by governmental and private interests in Tokyo to invest in rail over the last five decades has created a flexible planning environment. Infrastructure, by its very nature, is inflexible. But the land uses that surround infrastructure are flexible. Rail, because of its high carrying capacity, is an efficient mover of people in urban and regional corridors. Transit-oriented development, while by no means a panacea for all urban planning problems, does provide planners with a tool that is unavailable to planners in an auto-dominated region. Because the PRD is growing rapidly, and future flexibility is desirable, decision-makers should invest heavily in a regional rail network. As with, rail and TOD can be used to steer the growth and development of the region for decades to come.

More comprehensive planning approaches lead other opportunities for increasing the quality of life in the region. For example, interoperability between the region's transit systems would make travel throughout the region seamless. Electronic pricing technology, similar to the Octopus Card in use in Hong Kong, would allow for easy transfers between systems. Additional levels of infrastructure integration are also possible. For example, in both Paris and Tokyo, regional trains run on metro tracks as they travel through the city. This "through-running"[84] of regional rail on

---

http://www.worldbank.org/html/fpd/transport/publicat/twu23_ab.htm, 26 March 2000.
[83] London Research Centre, p. 27.
[84] Ibid. p. 199.

metro tracks increases passenger flows and greatly improves the quality of life for daily commuters.

To address the negative environmental consequences from over-dependence on car use, PRD leaders should develop region-wide car policies

Automobile use is growing all over the world. In transit-oriented regions in Asia (Tokyo and Singapore) and in Europe (Stockholm and Copenhagen), the desire to own a car has shifted the dynamics of regional mobility enough to give pause for concern to any transit advocate. However, there is a difference between car ownership and car use. The PRD could plan for a reasonable rate of growth in ownership rates while at the same time imposing financial disincentives that discourage car use. These disincentives, in order to be effective and to be considered rational by PRD residents, must be coupled with a high-quality transportation alternative. Together, these two actions--implementing car-use disincentives while supplying quality transit--comprise a comprehensive regional mobility policy.

There are many models for policy development along these lines. The transportation demand management policies implemented by Singapore are perhaps the most well known and certainly the most innovative in terms of the use of intelligent transportation systems (ITS). Under these schemes, Singapore administrators have been able to control the growth in car ownership and effectively manage vehicular traffic. They have also constructed one of the finest public transit systems in the world to serve as an alternative to the automobile.

CONCLUSION

The Pearl River Delta is at a critical stage in its evolution as a region. Will the PRD become a unified region—prosperous and competitive with the recognized global centers of trade, finance, and culture? Or will it dissolve into a region that is Balkanized; a collection of competitive municipalities, each making development decisions that are locally focused and that have no relationship to broader, regional programs of transportation and land-use planning, environmental protection, job location, or economic development? At this time, there are indications that the intense competition among localities to attract investment will prevail over a

long-term regional agenda that sets out programs for measured and sustainable development. If this is, indeed, the case, then it is at the region's long-term detriment.

This thesis has attempted to describe the impact that transportation and land-use policies have on how cities decentralize and urban regions grow. As the case studies pointed out, Tokyo invested predominantly in rail and used transit-oriented development as a strategic regional planning tool. New York, on the other hand, shifted from rail to development guided by highways and the automobile, pursuing few regional attempts to integrate land-use and transportation planning. Both directions are valid ways to go about regional development and both directions have costs. The automobile provides personal mobility, flexibility, and convenience but at a cost to the environment in terms of sprawl, poor air quality, and a loss of agricultural land. Transit, particularly when combined with land-use planning, offers planners the option to undertake long-term planning and development approaches. But this comes at the cost of decreased individual flexibility with regard to transportation. Like New York and Tokyo did before, PRD decision-makers have to decide how to invest their transportation dollars.

WHERE TO ACT NEXT

INTRODUCING REGIONALISM GRADUALLY

One of the recommendations of this thesis is to develop and install a regional government in the PRD. This recommendation was meant to be provocative more than a practical next step. Regional governance has worked in only a few areas—most notably Singapore—where the conditions that spawned such a governance structure—longevity of a single government administration, a small geographic area with no hinterland, and a stable and compliant population—would be difficult to replicate in most other regions of the world. And, of course, regional planning is no panacea—it is inherently bureaucratic and slow to respond to urgent planning concerns. However, the need for regional coordination in the PRD in specific areas is critical, particularly because the region is experiencing such rapid development.

The PRD could begin to approach specific regional concerns through the creation of public institutions, such as authorities, which could focus attention and resources on narrow, but regionally critical, areas of planning. For example, a regional transportation authority in the PRD could focus on setting road and rail standards in the region as well as contributing funds to local infrastructure development. In addition to construction and management, the authority could also establish funding mechanisms, such as an infrastructure bank, that could direct funds to priority infrastructure projects through the collection of dedicated fees. Describing the organizational structure of such an authority is outside the scope of this thesis. However, the point remains: A regional transportation authority could be an initial step toward establishing standards, setting regional priorities, and reigning in spending on duplicative and wasteful infrastructure projects. Furthermore, such an institution could serve as an important regional model upon which other authorities could be organized.

Overcoming Local Opposition

Another recommendation of this thesis is to integrate land-use and transportation planning. Such a recommendation would be very hard to carry out in the PRD—as it is has been in most regions—given the absence of regional institutions with leadership and oversight responsibilities and given, what would certain to be, local opposition to any loss of control over land use decisions. However, clearly a new development philosophy needs to be adopted in the region—one that recognizes the importance of plans that address social and environmental concerns as well as plans that pursue economic development. Convincing localities to give up revenues in the short-term in order to reap environmental benefits and improved transportation twenty years in the future will be challenging but necessary if the PRD is going to cross-over to a more sustainable path of development.

Developing an Automobile Policy

Leaders need to develop a reasonable policy concerning automobile use and ownership in the PRD. This one issue alone—the potential growth of automobile use and the impact of auto-

dependent development in the PRD— will have severe consequences for the region if it is not handled properly. Leaders in the PRD should consider developing policies that place the cost of car ownership and use out of the range of affordability for the majority of PRD residents. Tokyo and Singapore could both serve as models. Such policies may be considered regressive—the poorer PRD resident is harder hit than the well-off resident—however they are needed to assess, from the outset, a more accurate assignment of driving costs. The provision of high-quality transit needs to accompany these policies.

BIBLIOGRAPHY

Bureau of Transportation Statistics, "Transportation Demand Management for the 1990s." Available: http://www.bts.gov/tmip/papers/airqual/vsca/ch6.thm.

Cervero, Robert. *Transit Villages in the 21st Century*, New York: McGraw-Hill, 1997.

Cervero, Robert, *The Transit Metropolis: A Global Inquiry*, Washington: Island Press, 1998.

Consolidated Technical Report on the Territorial Development Strategy Review, Planning Department, Hong Kong Government, 1996.

Cooperative Mobility Program, Center for Technology, Policy, and Industrial Development, *International Mobility Observatory, Window on the World of Transportation Mobility*, (Cambridge: Massachusetts Institute of Technology, 1999).

Douglass, Mike. "East Asian Urbanization: Patterns, Problems, and Prospects," Asia/Pacific Research Center, Stanford University, July 1998.

Dunn Jr., James A. *Driving Forces: The Automobile, Its Enemies and the Politics of Mobility*, Washington, D.C.: Brooking Institute Press, 1998.

Four World Cities Transport Study : London, New York, Paris, Tokyo, London: London Research Centre, 1999.

Hebbert, Michael. "Sen-biki Amidst Desakota: Urban Sprawl and Urban Planning in Japan." In *Planning for Cities and Regions in Japan*, ed. Philip Shapira, Ian Masser, David W. Edgington, Liverpool: Liverpool University Press, 1994.

Hong Kong Trade Development Council. Available: http://www.tdctrade.com/mktprof/china/mpgud.htm

Kenworthy, Jeffrey and Peter Newman. *Sustainability and Cities: Overcoming Automobile Dependence*, Washington: Island Press, 1999.

McGee, T.G. "Metrofitting the Emerging Mega-Urban Regions of ASEAN: An Overview," In *The Mega-Urban Regions of Southeast Asia*, ed. T. G. McGee and Ira M. Robinson, Vancouver: UBC Press, 1995.

Mee Kan Ng and Wing-shing Tang. "The Pearl River Delta Urban Systems Plan: An Analysis." Hong Kong: The Chinese University of Hong Kong, 1997.

O'Neill, Hugh and Kathyrn Garcia, "Managing New York's Capital Crunch," Taub Urban Research Center, New York University, 1996.

Robinson, Ira M. "Emerging Spatial Patterns in ASEAN Mega-Urban Regions: Alternative Strategies." In *The Mega-Urban Regions of Southeast Asia*, ed. T. G. McGee and Ira M. Robinson, Vancouver: UBC Press, 1995.

Scott, James W. *Challenge of the Regional City: Political Traditions, the Planning Process, and Their Roles in Metropolitan Growth Management*, Berlin: Dietrich Reimer, 1992.

Shen. Q. "Urban Transportation in Shanghai, China: Problems and Planning Implications." *International Journal of Urban and Regional Research*, Vol. 21, No. 4, 1997. As cited by Robert Cervero, 1998.

Shoup, D. "The High Cost of Free Parking." *Access*, No. 10, 1997. As cited by Robert Cervero, 1998.

Srinivas, Hari. Urban Observatory, Japan Urban Observatory. Available: http://www.soc.titech.ac.jp.uem.observatory/jp-overview.html.

State of California, Legislative Analyst Report, "HOV Lanes in California: Are They Achieving Their Goals?", January 7, 2000. Available: http://www.lao.ca.gov/010700_hov/010700_hov_lanes.html.

Taniguchi, Mamoru. "Environmental Amenity in Growing Mega-City—Tokyo as Blend of East and West," *East West Perspectives on 21st Century Urban Development*, ed. John Brotchie, Peter Newton, Peter Hall, Jogn Dickey. Aldershot: Ashgate Publishing, 1999.

Teaford, Jon. *The Unheralded Triumph: City Government in America, 1870-1900,* Baltimore: Johns Hopkins University Press, 1983.

The New York Times, "Priorities at the Port Authority," Feb. 7, 1996.

The World Bank. "Transport in the City of Tomorrow: The Transport Dialogue at Habitat II." Available: http://www.worldbank.org/html/fpd/transport/publicat/twu23_ab.htm.

Tong, C. and Wong, S. "The Advantages of a High Density, Mixed Land-Use, Linear Urban Development," *Transportation*, Vol. 24, 1997.

U. S. Department of Transportation, Federal Highway Administration, "The Full Social Costs of Alternative Land Development Scenarios: Theory, Data, Models and Recommendations," June 1998.

U. S. Department of Transportation, Federal Transit Agency, "*Enhanced Planning Review of the New York City Metropolitan Area.*" Available: http://www.fta.dot.gov/ntl/index/html.

Wegener, Michael. "Tokyo's Land Market and Its Impact on Housing and Urban Life." In *Planning for Cities and Regions in Japan*, ed. Philip Shapira, Ian Masser, David W. Edgington, Liverpool: Liverpool University Press, 1994.

Yaro, Robert and Tony Hiss. *A Region at Risk: The Third Regional Plan for the New York-New Jersey-Connecticut Metropolitan Area.* Washington, D. C.: Island Press, 1996.
Bureau of Transportation Statistics, "Transportation Demand Management for the 1990s." Available: http://www.bts.gov/tmip/papers/airqual/vsca/ch6.thm.

Cervero, Robert. *Transit Villages in the 21st Century*, New York: McGraw-Hill, 1997.

Cervero, Robert, *The Transit Metropolis: A Global Inquiry*, Washington: Island Press, 1998.

Consolidated Technical Report on the Territorial Development Strategy Review, Planning Department, Hong Kong Government, 1996.

Cooperative Mobility Program, Center for Technology, Policy, and Industrial Development, *International Mobility Observatory, Window on the World of Transportation Mobility*, (Cambridge: Massachusetts Institute of Technology, 1999).

Dunn Jr., James A. *Driving Forces: The Automobile, Its Enemies and the Politics of Mobility*, Washington, D.C.: Brooking Institute Press, 1998.

Four World Cities Transport Study : London, New York, Paris, Tokyo, London: London Research Centre, 1999.

Hebbert, Michael. "Sen-biki Amidst Desakota: Urban Sprawl and Urban Planning in Japan." In *Planning for Cities and Regions in Japan*, ed. Philip Shapira, Ian Masser, David W. Edgington, Liverpool: Liverpool University Press, 1994.

Hong Kong Trade Development Council. Available:
http://www.tdctrade.com/mktprof/china/mpgud.htm

Kenworthy, Jeffrey and Peter Newman. *Sustainability and Cities: Overcoming Automobile Dependence*, Washington: Island Press, 1999.

McGee, T.G. "Metrofitting the Emerging Mega-Urban Regions of ASEAN: An Overview," In *The Mega-Urban Regions of Southeast Asia*, ed. T. G. McGee and Ira M. Robinson, Vancouver: UBC Press, 1995.

Mee Kan Ng and Wing-shing Tang. "The Pearl River Delta Urban Systems Plan: An Analysis." Hong Kong: The Chinese University of Hong Kong, 1997.

O'Neill, Hugh and Kathyrn Garcia, "Managing New York's Capital Crunch," Taub Urban Research Center, New York University, 1996.

Robinson, Ira M. "Emerging Spatial Patterns in ASEAN Mega-Urban Regions: Alternative Strategies." In *The Mega-Urban Regions of Southeast Asia*, ed. T. G. McGee and Ira M. Robinson, Vancouver: UBC Press, 1995.

Scott, James W. *Challenge of the Regional City: Political Traditions, the Planning Process, and Their Roles in Metropolitan Growth Management*, Berlin: Dietrich Reimer, 1992.

Shen. Q. "Urban Transportation in Shanghai, China: Problems and Planning Implications." *International Journal of Urban and Regional Research*, Vol. 21, No. 4, 1997. As cited by Robert Cervero, 1998.

Shoup, D. "The High Cost of Free Parking." *Access*, No. 10, 1997. As cited by Robert Cervero, 1998.

Srinivas, Hari. Urban Observatory, Japan Urban Observatory. Available: http://www.soc.titech.ac.jp.uem.observatory/jp-overview.html.

State of California, Legislative Analyst Report, "HOV Lanes in California: Are They Achieving Their Goals?", January 7, 2000. Available: http://www.lao.ca.gov/010700_hov/010700_hov_lanes.html.

Taniguchi, Mamoru. "Environmental Amenity in Growing Mega-City—Tokyo as Blend of East and West," *East West Perspectives on 21st Century Urban Development*, ed. John Brotchie, Peter Newton, Peter Hall, Jogn Dickey. Aldershot:

Teaford, Jon. *The Unheralded Triumph: City Government in America, 1870-1900,* Baltimore: Johns Hopkins University Press, 1983.

The New York Times, "Priorities at the Port Authority," Feb. 7, 1996.

The World Bank. "Transport in the City of Tomorrow: The Transport Dialogue at Habitat II." Available: http://www.worldbank.org/html/fpd/transport/publicat/twu23_ab.htm.

Tong, C. and Wong, S. "The Advantages of a High Density, Mixed Land-Use, Linear Urban Development," *Transportation*, Vol. 24, 1997.

U. S. Department of Transportation, Federal Highway Administration, "The Full Social Costs of Alternative Land Development Scenarios: Theory, Data, Models and Recommendations," June 1998.

U. S. Department of Transportation, Federal Transit Agency, "*Enhanced Planning Review of the New York City Metropolitan Area.*" Available: http://www.fta.dot.gov/ntl/index/html.

Wegener, Michael. "Tokyo's Land Market and Its Impact on Housing and Urban Life." In *Planning for Cities and Regions in Japan*, ed. Philip Shapira, Ian Masser, David W. Edgington, Liverpool: Liverpool University Press, 1994.

Yaro, Robert and Tony Hiss. *A Region at Risk: The Third Regional Plan for the New York-New Jersey-Connecticut Metropolitan Area.* Washington, D. C.: Island Press, 1996.

Zhang, Ming. "Working Paper," For: Hong Kong/ Pearl River Delta Research Group, July, 1999.